HLI HEKIMIAN LABORATORIES, INC.

A subsidiary of A. Johnson & Co., Inc.

Model 3934
Pulse Signaling Module

Operator's Manual

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PART NO. 3934-M20
Issue 2 (Draft), February 1987

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SECTION 1 - GENERAL

1.01 This manual contains information for operating the Model 3934 Pulse Signaling Module as part of the Model 3901 Communications Test System (CTS). This section contains a description and specifications for the Model 3934. Figure 1-1 is a front view of a Model 3934 Pulse Signaling Module equipped with the DX/FX Signaling Option .01A.

A. FUNCTIONAL DESCRIPTION

1.02 The microprocessor-controlled Model 3934 Pulse Signaling Module performs circuit supervision, and sends or measures dial pulses on a variety of signaling systems. It tests two-wire (2W) loop, 2W battery and ground, E and M (Types I, II, and III), and SF and DF signaling systems. Tests can be performed using either front panel controls or by adding Option .04, a remote-control device, DX/FX Option .01A extends the capabilities of the Model 3934 even further.

1.1 Circuit Supervision Features

1.03 The Model 3934 generates and detects on hook and off hook supervision for a variety of circuit interfaces. In E and M signaling interfaces, for example, the Model 3934 can emulate the supervisory functions of either a trunk circuit or a signaling circuit. Supervision can be detected with the module in a bridged configuration. This feature allows the determination to be made as to whether a circuit is available for testing, without interrupting service.

1.2 Send Capabilities

1.04 The Model 3934 can send pulses in three modes: continuous pulsing, repeating digit, and dialed number. Continuous pulsing is a repetitive string of on hook and off hook states. In the repeating digit mode, a pulse pattern for the single digit entered via the front panel keyboard is sent continuously. In the dialed number mode, pulse patterns for the digits entered via the front panel keyboard are sent as they are entered. The pulse speed and percent break (%BK)

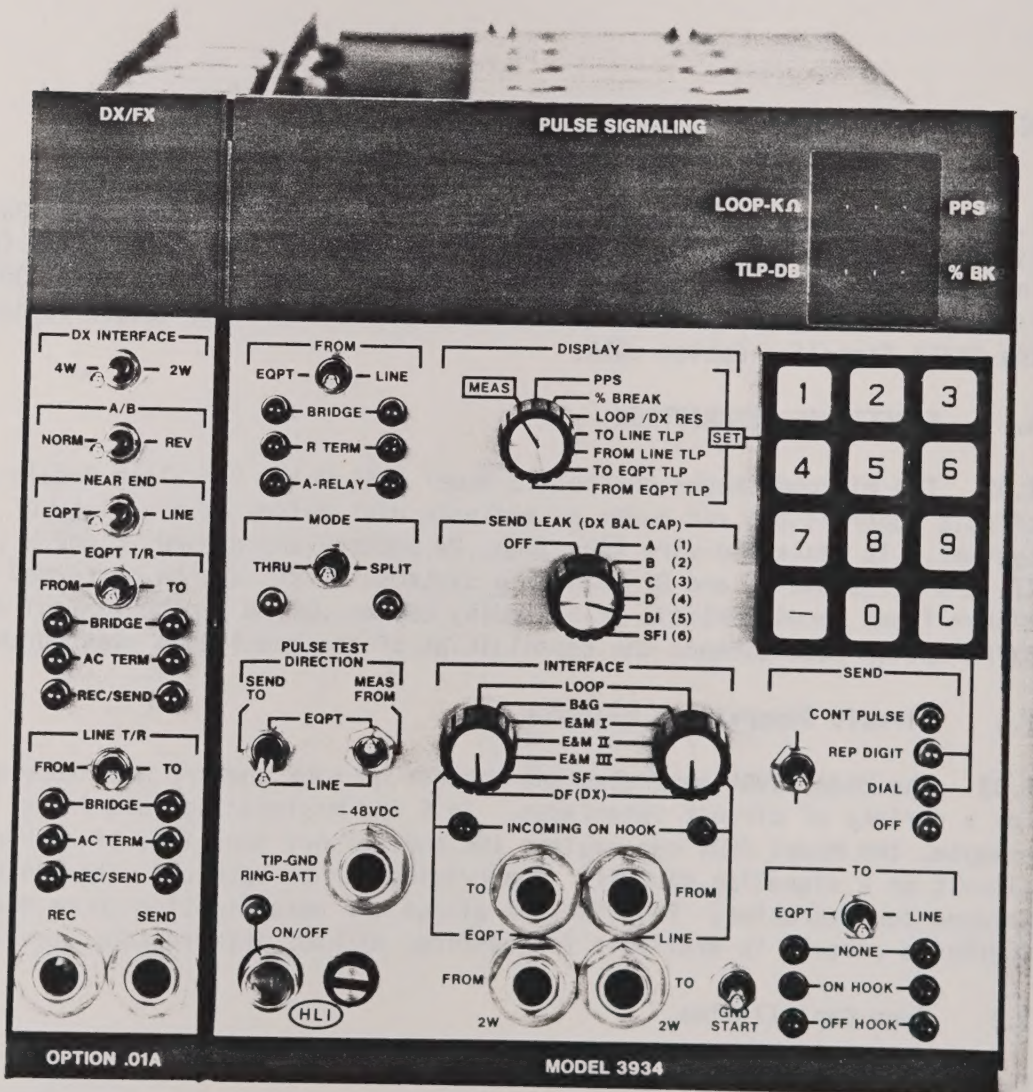


Figure 1-1. Model 3934 Pulse Signaling Module
(with DX/FX Signaling Option .01A)

are adjustable in all of these transmission modes. When ending pulses on dc loop signaling systems, the module provides standard leak test conditions and an adjustable loop resistance for the circuit under test. This feature allows the module to emulate various circuit loading conditions. When sending pulses on ac systems, the Transmission Level Point (TLP) can be adjusted to meet circuit signal power requirements.

1.3 Measurement Capabilities

1.05 For pulse measurements, the Model 3934 can be bridged across the circuit, provide a resistive termination, or for dc loop signaling systems can provide an A-relay termination. To ensure measurement accuracy, the RECEIVE TLP can be adjusted for ac systems. The module displays measurements as pulses per second (PPS) and %BK. The Model 3934 features independent send and measure functions and circuit connections. This allows the module to be connected to two different signaling systems simultaneously, which provides easy testing of signal converters.

1.4 DX/FX Signaling Option .01A

1.06 DX/FX Option .01A adds balancing networks to terminate DX/FX signaling systems, and the ability to reverse the A/B leads. It also expands the signaling capabilities of the module to include not only DX but four-wire (4W) loop and 4W battery and ground. Also provided is the capability to interface FX circuits, either loop-start or ground-start, on a loop or SF signaling basis. For example, with FX circuits, the module can detect supervision as either the FXO (central office end) or the FXS (station end) unit. With this option, the ringing sequence and the idle/busy status in PBX ground start circuits can also be detected. Option .01A includes Remote Control Option .04.

1.5 Remote Control Option .04

1.07 Adding Remote Control Option .04 allows operation of the Model 3934 from a remote location, making it possible to perform multipoint network testing from one central location. Option .04 also adds the ability to detect supervision on wink-start trunks.

B. SPECIFICATIONS

1.08 Specifications for the Model 3934 are contained in Table 1-1. Specifications for DX/FX Signaling Option .01A are contained in Table 1-2. Table 1-3 provides specifications for Remote Control Option .04.

TABLE 1-1. MODEL 3934 PULSE SIGNALING MODULE SPECIFICATIONS

OPERATING MODES (Independent)	Receive Pulse Signaling Send Pulse Signaling
SIGNALING MODES (Send and Receive)	2W Loop 2W Battery & Ground E&M (Types I, II and III) Single Frequency (2600 Hz) Dual Frequency (DF) (2600 Hz, 2800 Hz) (Not available with DX/FX Option .01A)
CONNECTION MODES	
Thru	Bridge only
Split	Bridge or Terminate
RECEIVE MEASUREMENTS	
Speed	
DC Pulsing	5.5 pps to 23.0 pps
AC Pulsing	5.5 pps to 14.0 pps
Speed Accuracy	±0.2 pps
Pulse Ratio	
DC Pulsing	15% break to 85% break
AC Pulsing	20% break to 80% break
Pulse Ratio Accuracy	
DC Pulsing	±0.3% break
AC Pulsing	±0.5% break
Interdigital Interval	260 ms or greater
Receive TLP (SF and DF)	-30 dB to +10 dB
SF and DF Receiver Sensitivities	(DF not available with DX/FX Option .01A)
2600 Hz	-29 dBm0
2800 Hz	-16 dBm0
Input Pulse Requirements	At least two pulses required for measurements to be made.
RECEIVE CIRCUIT IMPEDANCE	
Loop and Battery & Ground	5 MΩ bridging, 400 Ω or A-relay terminated
E&M	2.5 MΩ bridging, 2.2 KΩ terminated
SF and DF	30 kΩ bridging, 750 Ω terminated (DF not available with DX/FX Option .01A)

TABLE 1-1. MODEL 3934 PULSE SIGNALING MODULE SPECIFICATIONS (Continued)

SEND SECTION	
Pulse Speed Range	5.5 pps to 23.0 pps
Speed Accuracy	±0.2 pps
Pulse Ratio Range	
DC Pulsing	20% break to 80% break
AC Pulsing	30% break to 80% break
Pulse Ratio Accuracy	±0.2% break
Transmit TLP	
(SF & DF)	-30 dB to +10 dB
SF and DF Frequencies	2600 Hz, 2800 Hz, ±5 Hz
SF and DF Levels	
Pulsing	-8 dBm0
Steady	-20 dBm0
Send Loop Resistance	
Selection	0 to 6.3 kΩ in 0.1 kΩ steps
Send Leak Selection	A, B, C, D, D1, SF1 or none
Send Functions	Steady on-hook Steady off-hook Continuous train of pulses Continuous repeating of one digit Outpulsing of digits entered on keypad
Interdigital Interval	700 ms
DISPLAY	Dual 3-digit
INDICATORS	INCOMING ON HOOK THRU/SPLIT MODE Receive Circuit Terminations Send Circuit Status Pulse Send Mode Module ON
OPTIONS	.04 Remote Control .01A DX/FX
MODULE SIZE	4 single-width module spaces
MODULE WEIGHT	6 lbs., 9oz. (3.0 kg.)

TABLE 1-2. DX/FX SIGNALING OPTION .01A SPECIFICATIONS

SIGNALING MODES (Additional Send and Receive capabilities)	4W Loop 4W Battery and Ground DX (2W or 2W) Foreign Exchange (FX)
CIRCUIT INTERFACE	
DX Bridging Impedance	500 kΩ
DX Loop Build Out Resistance	0 to 6.3 kΩ in 0.1 kΩ steps in either EQPT or LINE direction
DX Balance Resistance	1.25 kΩ plus 0 to 6.3 kΩ in 0.1kΩ steps
DX Balance Capacitance	0 to 6μF steps
Normal A/B Polarity	
A-Lead	2W: Tip 4W: From EQPT/to LINE
B-Lead	2W: Ring 4W: From LINE to EQPT
FX STATUS DETECTION (Remote Only)	SF
Signaling Modes	2W Loop 4 W Loop
Circuit	Loop-start Ground-start
Status Condition	Idle/Busy/Ring Tip Ground
FX Ring Signal (Remote Only)	2 sec On/4 sec Off
Loop-start	ON HOOK
Ground-start	20 pps
ADDITIONAL INDICATORS	EQPT T/R Circuit Terminations LINE T/R Circuit Terminations
REMOTE CONTROL	Option .04 is included in .01A
MODULE SIZE (Total)	5 single-width module spaces
MODULE WEIGHT (Total)	9 lbs., 2 oz. (4.1 kg.)

TABLE 1-3. REMOTE CONTROL OPTION .04 SPECIFICATIONS

OPERATING MODE	Duplicates all front panel control and indicator functions of the 3934 or 3934.01A option
WINK DETECT	
No Action	Off hook less than 5 ms
Short Wink	Off hook: 5 ms to 100 ms
Wink	Off hook: 100 ms to 350 ms
Off Hook	Off hook more than 350 ms
Threshold Accuracy	± ms
Wink Detect Time Period	5 sec

HLI reserves the right to make changes in specifications at any time without notice.

SECTION 2 - CONTROLS, INDICATORS AND JACKS

2.01 This section contains descriptions of all controls, indicators and jacks on the Model 3934 Pulse Signaling Module and DX/FX Signaling Option .01A.

A. MODEL 3934 FRONT PANEL DESCRIPTION

2.02 The following component descriptions are keyed to Figure 2-1.

1. **Module Extractor Screw:** Secures the module in the Model 3900 CTS.

2. **ON/OFF Switch:** Momentary pushbutton switch to turn the module power on or off in the manual operational mode.

3. **ON/OFF Indicator:** LED lights when the module is on.

4. **-48 VDC Jack:** WECO 310 type phone jack which provides the office battery input to the module, for various dc send and receive conditions.

5. **PULSE TEST DIRECTION Switches**

   SEND TO Switch: Selects the direction of transmission for the pulse generator.

   MEAS FROM Switch: Selects the direction from which pulse measurements are taken.

6. **MODE THRU-SPLIT Indicators:** LEDs light to indicate the status of the connection between the module and the signaling circuit.

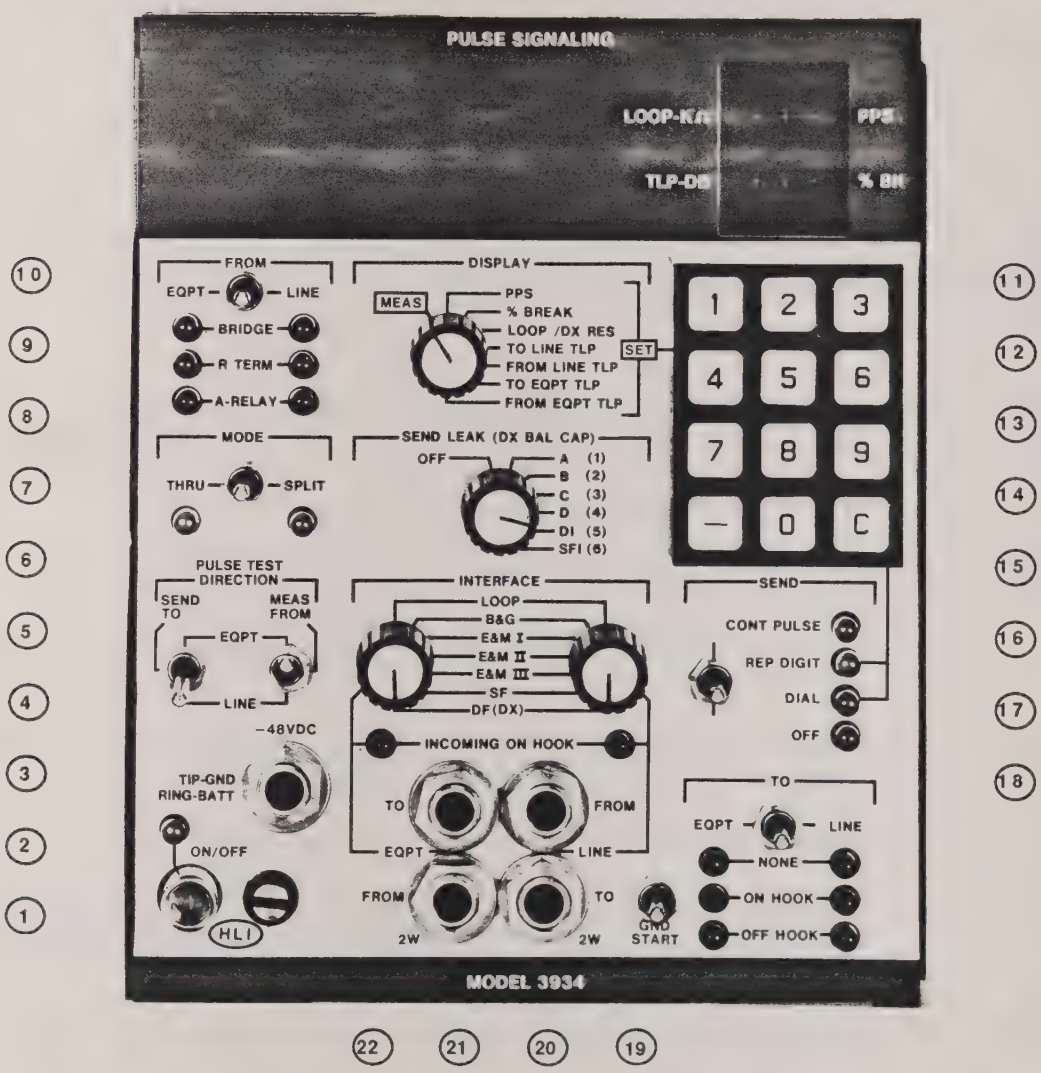


Figure 2-1. Model 3934 Front Panel Features

7. MODE THRU-SPLIT Switch: Controls whether a thru connection is provided to the signaling circuit or whether the circuit is split. The mode is changed by momentarily pressing the switch to either the THRU or SPLIT position.

8. **FROM EQPT-LINE Indicators:** LEDs light to indicate the status of the measure circuit terminations on the EQPT or LINE interfaces.

9. **FROM EQPT-LINE Switch:** Controls the receive circuit termination on the equipment and line sides, the termination is changed by momentarily toggling the switch to either EQPT or LINE position. Each toggle action causes a step through the sequence of BRIDGE, R TERM, and A-RELAY. The A-RELAY termination is allowed only for LOOP or B&G jetting of the INTERFACE switches, Number 16 and Number 23.

10. **DISPLAY Rotary Switch:** Selects which parameter is to be displayed on the LED display. (The LOOP/DX RES position is used only with modules equipped with DX Signaling Option .01A. In this position, the values of the loop series resistance representing line losses and two DX balance resistances are simultaneously selected to balance the network. Selectable values are from 0 to 6.3 Kohm, in 0.1 Kohm steps. The DX balance resistance is 1.2 Kohm plus the keyboard-selected value for the loop series resistance. The default values are 1.2 Kohm loop series resistance and 2.4 Kohm DX balance resistors.)

11. **LED Display:** Presents the information specified by the DISPLAY switch setting.

12. **SET Keypad:** Performs the following functions:

    - Sets the value of the parameter selected via the DISPLAY switch.

    - Provides the digit input in the REP DIGIT and DIAL SEND modes of operation, Number 14 and Number 15.

    - Calls back the last measurement displayed.

13. **SEND LEAK (DX BAL CAP) Rotary Switch:** Selects the type of LEAK conditions that can be inserted on the circuit during pulsing tests. In the OFF position, no leak network is applied. This switch also selects the capacitance value placed in the DX balancing networks for modules equipped with the DX Signaling Option .01A.

14. **SEND Mode Indicators:** LEDs light to indicate the type of out-pulsing performed by the module in the SEND mode.

    A. **OFF** - No pulses are transmitted and the signaling circuit remains off hook.

    B. **DIAL** - Digits are outpulsed in accordance with the entries made on the keypad switch.

    C. **REP DIGIT** - The digit which is keyed on the keypad switch is out-pulsed continuously.

    D. **CONT PULSE** - A continuous pulse train is transmitted.

15. **SEND Mode Switch:** Selects the type of outpulsing performed by the module in the SEND mode, by momentarily toggling the switch up or down.

16. **LINE INTERFACE Rotary Switch:** Selects the signaling circuit interface that is connected to the LINE side of the module.

17. **TO EQPT-LINE Switch:** Selects the supervisory signaling applied in either the LINE or EQPT direction. The supervision is changed by momentarily toggling the switch to either EQPT or LINE. Each toggle action causes a step through the sequence of NONE, ON HOOK, and OFF HOOK.

18. **TO EQPT-LINE Indicators:** LEDs light to indicate the supervisory signal status in either the LINE or EQPT direction.

19. **GND START Switch:** Provides a momentary ground on the ring lead in the OFF HOOK condition with a LOOP INTERFACE.

20. **LINE FROM/TO 2W Jacks:** WECO 310 type phone jacks that provide the line side connections to the signaling circuit.

21. **EQPT TO/FROM 2W Jacks:** WECO 310 type phone jacks that provide the equipment side connections to signaling circuit.

22. **INCOMING ON HOOK Indicators:** LEDs light to indicate when an on-hook condition is detected on the FROM circuit in either the EQPT or LINE direction.

23. EQPT INTERFACE Rotary Switch: Selects the signaling circuit interface that is connected to the EQPT side of the module.

B. DX SIGNALING OPTION .01A FRONT PANEL DESCRIPTION

2.03 The following component descriptions are keyed to Figure 2-2.

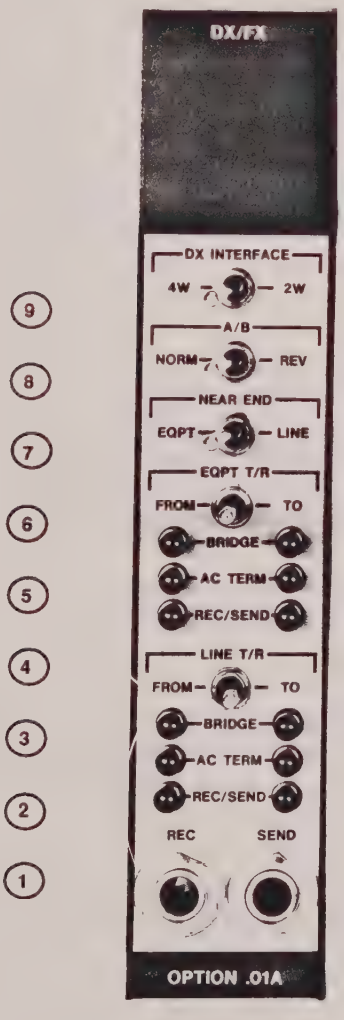


Figure 2-2. Option .01A Front Panel Features

1. **VF SEND Jack:** WECO 310 type phone jack which provides access to the VF send pair of the 4-wire circuit connected to the EQPT/LINE interface jacks of the Model 3934 Basic Unit. On a 2-wire circuit, it provides access to LINE 2W jack.

2. **VF REC Jack:** WECO 310 type phone jack which provides access to the VF receive pair of the 4-wire circuit connected to the EQPT/LINE interface jacks of the Model 3934 Basic Unit. On a 2-wire circuit, it provides access to the FROM EQPT 2W jack.

3. **LINE T/R Indicators:** LEDs light to indicate the status of the VF circuit terminations on the LINE INTERFACE jacks.

4. **LINE T/R FROM-TO Switch:** Selects the VF circuit terminations on the LINE INTERFACE jacks. The selection is changed by momentarily toggling the switch to either the FROM or TO position.

5. **EQPT T/R Indicators:** LEDs light to indicate the status of the VF circuit terminations on the EQPT INTERFACE jacks.

6. **EQPT T/R FROM-TO Switch:** Selects the VF circuit terminations on the EQPT INTERFACE jacks. The selection is changed by momentarily toggling the switch to either the FROM or TO position.

7. **NEAR END EQPT-LINE Switch:** Selects the INTERFACE jacks to which the loop series resistance network is connected.

8. **A/B NORM-REV Switch:** Selects the condition of the A and Ba lead configuration in the Model 3934. Normal position for a 2W system are A-Tip and B-Ring and i a 4W system A-FROM EQPT/TO LINE and B-FROM LINE/to EQPT.

9. **DX INTERFACE 4W-2W Switch:** Selects the circuit interface configuration of the EQPT and LINE jacks within the Model 3934.

SECTION 3 - OPERATING INSTRUCTIONS

A. INTRODUCTION

Operation of the Model 3934 consists of connecting power to the unit, peforming functional checks, and then performing pulse signaling tests and measurements. Information on each of these topics is provided in the following sections.

B. -48 VDC INPUT CONNECTIONS

Establishing the -48 VDC input to the Model 3934 is essential to proper operation of the module. The presence of -48 VDC and a positive ground are required to perform supervisory signaling where battery and ground indicate the status of the circuit. Also, Loop, B&G, E&M, and DX signaling systems all use some form of dc pulse signaling derived from this input.

To connect the -48 VDC input, proceed as follows:

> NOTE: Use only a WECO 310 type phone plug or equivalent for the connection to the -48 VDC jack on the Model 3934. Use of other types of plugs may deform the jack and cause equipment malfunction.

STEP	ACTION
1	Install the module in the Model 3901 Basic Unit or Model 3910 Expander Unit (if required) as described in Section 4 of this manual.

STEP	ACTION
2	Connect a lead from the office ground to the tip lead of a WECO 310 cable assembly.
	NOTE: For the proper operation of this module this must be a positive or earth ground. If a source other than a positive ground office battery is used for the -48 VDC, it will be necessary to establish a positive ground. To establish this positive ground connect a lead from the ground post located on the front panel of the Model 3901 Basic Unit to the positive or ground output terminal of the power supply.
3	Connect a -48 VDC office battery lead to the ring lead of the WECO 310 cable assembly.
4	Connect the WECO 310 cable assembly to the -48 VDC jack on the front panel of the Model 3934.
	NOTE: The Model 3934 will cause a maximum current loading of 350 mA on the office battery.

C. FUNCTIONAL TESTS

NOTE: A properly grounded -48 VDC input must be connected to the Model 3934. Failure to provide this dc voltage source will lead to failure of the functional tests. Refer to Section B, -48 VDC INPUT CONNECTIONS, for more details.

This section describes the lamp test and functional checks which can be performed on the Model 3934. Functional checks can be performed to confirm proper operation of the module. These checks only verify proper operation of the module and are not for calibration checks. The functional tests should be performed at the time of module set-up and when a module malfunction is suspected.

NOTE: If a possible malfunction is detected, contact the factory for advice and the necessary corrective action.

3.1 Lamp Test

STEP	ACTION	VERIFICATION
1	Push in the POWER switch on the Model 3901 Basic Unit to turn the unit on (if required).	
2	Push in the ON/OFF switch on the Model 3934 to turn the module on (if required).	The ON/OFF LED is on.
3	Locate the LAMP TEST switch on the rear panel of the Model 3901 Basic Unit. NOTE: Toggling this switch lights all the digital displays and indicators on the Model 3901 Basic Unit and plug-in modules that are on.	
4	Move and hold the LAMP TEST switch to the ON position.	All Model 3934 front panel LEDs are on, the LOOP-KΩ/PPS display indicates 88.8, and the TLP -DB/% BK display indicates 88.8.

3.2 Loop Signaling Check

NOTE: A WECO 310 type cable is required for this procedure.

STEP	ACTION	VERIFICATION
1	Rotate the DISPLAY switch knob to align the pointer with the MEAS line (if required).	
2	Push in the POWER switch on the Model 3901 Basic Unit to turn the unit on (if required).	
3	Push in the ON/OFF switch on the Model 3934 to turn the module on (if required).	The ON/OFF LED is on.
4	Rotate the EQPT, INTERFACE switch knob to align the pointer with the LOOP line.	
5	Rotate the LINE, INTERFACE switch knob to align the pointer with the LOOP line.	
6	Set the PULSE TEST DIRECTION, SEND TO switch to EQPT.	
7	Set the PULSE TEST DIRECTION, MEAS FROM switch to LINE.	
8	Connect one end of a WECO 310 type cable to the FROM EQPT 2W jack and the other end to the TO LINE 2W jack on the Model 3934.	
9	Toggle the FROM, EQPT-LINE switch to LINE, R TERM. NOTE: Toggle the switch towards the LINE label.	The LINE, R TERM LED is on. The EQPT and LINE, INCOMING ON HOOK LEDs are on.

STEP	ACTION	VERIFICATION
10	Rotate the DISPLAY switch knob to align the pointer with the LOOP/DX RES line.	The display should show a value of 1.2 KΩ. If some other value is shown, enter 1.2 following the procedures in Section 3.8.
11	Reset the DISPLAY switch knob to MEAS.	
12	Toggle the TO, EQPT-LINE switch to EQPT, OFF HOOK. NOTE: Toggle the switch towards the EQPT label.	The EQPT, OFF HOOK LED is on. The LINE, INCOMING ON HOOK LED is off.
13	Toggle the SEND mode switch to CONT PULSE. NOTE: Toggle the switch in the up direction.	The CONT PULSE LED is on. The EQPT, ON HOOK and OFF HOOK LEDs are flashing alternately. The LINE, INCOMING ON HOOK LED is flashing. The display shows 9.9 - 10.1 PPS and 59.9 - 60.1 % BK.
14	Rotate the DISPLAY switch knob to align the pointer with the LOOP/DX RES line.	The display shows 1.2 kΩ.
15	Set the value on the display to 1.6 kΩ. NOTE: Follow the procedures in Paragraph 3.06 to set the new value.	The display shows 1.6 kΩ after being set.
16	Reset the DISPLAY switch knob. to MEAS.	

STEP	ACTION	VERIFICATION
17	Toggle the FROM, EQPT-LINE switch to LINE, A-RELAY. NOTE: Toggle the switch towards the LINE label.	The LINE, A-RELAY LED is on. The display shows 9.9 - 10.1 PPS and 73.5 - 74.5 % BK. NOTE: The range of 73.5 - 74.5 % BK is expected if the office battery voltage is -51.0V dc. For each one volt decrease in office battery voltage, the expected % BK reading increases by 0.8 % BK.
18	Toggle the TO, EQPT-LINE switch to LINE, OFF HOOK. NOTE: Toggle the switch towards the LINE label.	The LINE, OFF HOOK LED is on. The EQPT, INCOMING ON HOOK LED is out. The display shows the same values as Step 17. The ON/OFF LED is on.

3.3 Battery and Ground Signaling Check

NOTE: A WECO 310 type cable is required for this procedure.

STEP	ACTION	VERIFICATION
1	Rotate the DISPLAY switch knob to align the pointer with the MEAS line (if required).	
2	Push in POWER switch on the Model 3901 Basic Unit to turn the unit on (if required).	
3	Push in the ON/OFF switch on the Model 3934 to turn the module on (if required).	

STEP	ACTION	VERIFICATION
4	Rotate the EQPT, INTERFACE switch knob to align the pointer with the B&G line.	
5	Rotate the LINE, INTERFACE switch knob to align the pointer with the B&G line.	
6	Set the PULSE TEST DIRECTION, SEND TO switch to EQPT.	
7	Set the PULSE TEST DIRECTION, MEAS FROM switch to LINE.	
8	Connect one end of a WECO 310 type cable to the FROM EQPT 2W jack and the other end to the TO LINE 2W jack on the Model 3934.	
9	Toggle the FROM, EQPT-LINE switch to LINE, R TERM. NOTE: Toggle the switch towards the LINE label.	The LINE, R TERM LED is on. The EQPT and LINE, INCOMING ON HOOK LEDs are on.
10	Toggle the TO, EQPT-LINE switch to EQPT, OFF HOOK. NOTE: Toggle the switch towards the EQPT label.	The EQPT, OFF HOOK LED is on. The LINE, INCOMING ON HOOK LED is off.

STEP	ACTION	VERIFICATION
11	Toggle the SEND mode switch to CONT PULSE. NOTE: Toggle the switch in the up direction.	The CONT PULSE LED is on. The EQPT, ON HOOK and OFF HOOK LEDs are flashing alternately. The LINE, INCOMING ON HOOK LED is flashing. The display shows 9.9 - 10.1 PPS and 67.1 - 68.1 % BK. NOTE: The range of 67-1 -68.1 % BK is expected if the office battery voltage is -51.0V dc. For each one volt decrease in office battery voltage, the expected % BK reading increases by 0.5% BK.

3.4 E&M Signaling Check

NOTE: A WECO 310 type cable is required for this procedure.

STEP	ACTION	VERIFICATION
1	Rotate the DISPLAY switch knob to align the pointer with the MEAS line (if required).	
2	Push in the POWER switch on the Model 3901 Basic Unit to turn the unit on (if required).	
3	Push in the ON/OFF switch on the Model 3934 to turn the module on (if required).	The ON/OFF LED is on.
4	Rotate the EQPT, INTERFACE switch knob to align the pointer with any E&M line: E&M I, E&M II, and E&M III.	

STEP	ACTION	VERIFICATION
5	Rotate the LINE, INTERFACE switch knob to the same E&M type selected in Step 4.	
6	Set the PULSE TEST DIRECTION, SEND TO switch to EQPT.	
7	Set the PULSE TEST DIRECTION, MEAS FROM switch to LINE.	
8	Connect one end of WECO 310 type cable to the FROM EQPT 2W jack and the other end to the TO LINE 2W jack on the Model 3934.	
9	Toggle the FROM, EQPT-LINE switch to LINE, R TERM. **NOTE:** Toggle the switch towards the LINE label.	The LINE, R TERM LED is on.
10	Toggle the FROM, EQPT-LINE switch to EQPT, R TERM. **NOTE:** Toggle the switch towards the EQPT label.	The EQPT, R TERM LED is on.The EQPT and LINE, INCOMING ON HOOK LEDs are on.
11	Set the TO, EQPT-LINE switch to EQPT, OFF HOOK. **NOTE:** Toggle the switch towards the EQPT label.	The EQPT, OFF HOOK LED is on. The LINE, INCOMING ON HOOK LED is off.

STEP	ACTION	VERIFICATION
12	Toggle the SEND mode switch to CONT PULSE. NOTE: Toggle the switch in the up direction.	The CONT PULSE LED is on. The EQPT, ON HOOK and OFF HOOK LEDs are flashing alternately. The LINE, INCOMING ON HOOK LED is flashing. The display shows 9.9 - 10.1 PPS and 59.9 - 60.1 % BK.
13	Set the PULSE TEST DIRECTION, SEND TO switch to LINE.	
14	Set the PULSE TEST DIRECTION, MEAS FROM switch to EQPT.	
15	Toggle the TO, EQPT-LINE switch to LINE, OFF HOOK. NOTE: Toggle the switch towards the LINE label.	The LINE, OFF HOOK LED is on. The EQPT, INCOMING ON HOOK. LED is off.
16	Toggle the SEND mode switch to CONT PULSE. NOTE: Toggle the switch in the up direction.	The CONT PULSE LED is on. The LINE, ON HOOK and OFF HOOK LEDs are flashing alternately. The EQPT, INCOMING ON HOOK LED is flashing. The display shows 9.9 - 10.1 PPS and 59.9 - 60.1% BK.

3.5 SF Signaling Check

NOTE: A WECO 310 type cable is required for this procedure.

STEP	ACTION	VERIFICATION
1	Rotate the DISPLAY switch knob to align the pointer with the MEAS line (if required).	
2	Push in the POWER switch on the Model 3901 Basic Unit to turn the unit on (if required).	

STEP	ACTION	VERIFICATION
3	Push in the ON/OFF switch on the Model 3934 to turn the module on (if required).	The ON/OFF LED is on.
4	Rotate the EQPT, INTERFACE switch knob to align the pointer with the SF line.	
5	Rotate the LINE, INTERFACE switch knob to align the pointer with the SF position.	
6	Set the PULSE TEST DIRECTION, SEND TO switch to EQPT.	
7	Set the PULSE TEST DIRECTION, MEAS FROM switch to LINE.	
8	Connect one end of a WECO 310 type cable to the TO EQPT jack and the other end to the FROM LINE jack on the Model 3934.	
9	Toggle the FROM, EQPT-LINE switch to LINE, R TERM. NOTE: Toggle the switch towards the LINE label.	The LINE, R TERM LED is on.

STEP	ACTION	VERIFICATION
10	Toggle the TO, EQPT-LINE switch to EQPT, ON HOOK. NOTE: Toggle the switch towards the EQPT label.	The EQPT, ON HOOK LED is on. The LINE, INCOMING ON HOOK LED is on.
11	Toggle the TO, EQPT-LINE switch to EQPT, OFF HOOK. NOTE: Toggle the switch towards the EQPT label.	The EQPT, OFF HOOK LED is on. THE LINE, INCOMING ON HOOK LED is off.
12	Toggle the SEND mode switch to CONT PULSE. NOTE: Toggle the switch in the up direction.	The CONT PULSE LED is on. The EQPT, ON HOOK and OFF HOOK LEDs are flashing alternately. The LINE, INCOMING ON HOOK LED is flashing. The display shows 9.9 - 10.1 PPS and 59.5 - 60.5% BK.
13	Set the PULSE TEST DIRECTION, SEND TO switch to LINE.	
14	Set the PULSE TEST DIRECTION, MEAS FROM switch to EQPT.	
15	Connect one end of a WECO type 310 cable to the FROM EQPT 2W jack and the other end to the TO LINE 2W jack on the Model 3934.	
16	Toggle the FROM, EQPT-LINE switch to EQPT, R TERM. NOTE: Toggle the switch towards the EQPT label.	The EQPT, R TERM LED is on.

STEP	ACTION	VERIFICATION
17	Toggle the TO, EQPT-LINE switch to LINE, ON HOOK. NOTE: Toggle the switch towards the LINE label.	The LINE, ON HOOK LED is on. The EQPT, INCOMING ON HOOK LED is on.
18	Toggle the TO, EQPT-LINE switch to LINE, OFF HOOK. NOTE: Toggle the switch towards the LINE label.	The LINE, OFF HOOK LED is on. The EQPT, INCOMING ON HOOK LED is off.
19	Toggle the SEND mode switch to CONT PULSE. NOTE: Toggle the switch in the up direction.	The CONT PULSE LED is on. The LINE, ON HOOK and OFF HOOK LEDs are flashing alternately. The EQPT, INCOMING ON HOOK LED is flashing. The display shows 9.9 - 10.1 PPS and 59.5 - 60.5% BK.

3.6 DF Signaling Check

NOTE: The following test procedure can not be performed on a Model 3934 equipped with DX Signaling Option .01A. A WECO 310 type cable is required for this procedure.

STEP	ACTION	VERIFICATION
1	Rotate the DISPLAY switch knob to align the pointer with the MEAS line (if required).	
2	Push in the POWER switch on the Model 3901 Basic Unit to turn the unit on (if required).	
3	Push in the ON/OFF switch on the Model 3934 to turn the module on (if required).	The ON/OFF LED is on.

STEP	ACTION	VERIFICATION
4	Rotate the EQPT INTERFACE switch knob to align the pointer with the DF (DX) line.	
5	Rotate the LINE INTERFACE switch knob to align the pointer with DF (DX) line.	
6	Set the PULSE TEST DIRECTION, SEND TO switch to EQPT.	
7	Set the PULSE TEST DIRECTION, MEAS FROM switch to LINE.	
8	Connect one end of a WECO 310 type cable to the TO EQPT jack and the other end to the FROM LINE jack on the Model 3934.	
9	Toggle the FROM, EQPT-LINE switch to LINE, R TERM. NOTE: Toggle the switch towards the LINE label.	The LINE, R TERM LED is on.
10	Toggle the TO, EQPT-LINE switch to EQPT, ON HOOK NOTE: Toggle the switch towards the EQPT label.	The EQPT, ON HOOK LED is on. The LINE, INCOMING ON HOOK LED is on.
11	Toggle the TO, EQPT-LINE switch to EQPT OFF HOOK. NOTE: Toggle the switch towards the EQPT label.	The EQPT, OFF HOOK LED is on. The LINE, INCOMING ON HOOK LED is off.

STEP	ACTION	VERIFICATION
12	Toggle the SEND mode switch to CONT PULSE. **NOTE:** Toggle the switch in the up direction.	The CONT PULSE LED is on. The EQPT, ON HOOK and OFF HOOK LEDs are flashing alternately. The LINE, INCOMING ON HOOK LED is flashing. The display shows 9.9 - 10.1 PPS and 59.5 - 50.5% BK.
13	Set the PULSE TEST DIRECTION, SEND TO switch to LINE.	
14	Set the PULSE TEST DIRECTION, MEAS FROM switch to EQPT.	
15	Connect one end of the WECO 310 type cable to the FROM EQPT 2W jack and the other to the TO LINE 2W jack on the Model 3934.	
16	Toggle the FROM, EQPT-LINE switch to EQPT, R TERM. **NOTE:** Toggle the switch towards the EQPT label.	The EQPT, R TERM LED is on.
17	Toggle the TO, EQPT-LINE switch to LINE, ON HOOK. **NOTE:** Toggle the switch towards the LINE label.	The LINE, ON HOOK LED is on. The EQPT, INCOMING ON HOOK LED is on.
18	Toggle the TO, EQPT LINE switch to LINE, OFF HOOK. **NOTE:** Toggle the switch in towards the LINE label.	The LINE, OFF HOOK LED is on. The EQPT, INCOMING ON HOOK LED is off.
19	Toggle the SEND mode switch to CONT PULSE. **NOTE:** Toggle the switch in the up direction.	The CONT PULSE LED is on. The LINE, ON HOOK and OFF HOOK LEDs are flashing alternately. The EQPT, INCOMING ON HOOK LED is flashing. The display shows 9.9 - 10.1 PPS and 59.5 - 60.6% BK.

D. MEASUREMENT AND TEST INSTRUCTIONS

3.7 Operational Features

This section provides an overview and explanation of operational features contained within the Model 3934. Each of the following paragraphs discusses a particular operational feature provided by the Model 3934. The features described are listed in order for ease of reference.

- Incremental send-loop resistance on the pulse-generating circuit
- Six switchable send-leak networks.
- Supervisory signaling in both the drop and line directions.
- Loop circuit ground start seizure capability.
- Access to the circuit in either a "thru" or "split" mode.
- Three measurement configurations: BRIDGE, Resistive Termination (R TERM), and A-RELAY.
- The pulse generator operates in three modes: continuous pulse (CONT PULSE), repetitive digit (REP DIGIT), and DIAL.
- Overrange and underrange indications.
- Last measurement storage in memory.
- Displays measurement results after receipt of two pulses.
- Measures first pulse distortion.

Incremental send-loop resistance is provided and can be inserted in the pulse-generating send circuit ahead of the interface jacks. This balanced resistive loading simulates the loop resistance encountered between signaling units in a loop or battery and ground signaling system. The send-loop resistance is one of the Model 3934 operating parameters, and is settable in a range from 0.0 to 6.3kΩs, in 0.1kΩ increments.

Supervisory signaling is provided in both the drop (EQPT) and facility (LINE) directions. The switch labeled TO EQPT-LINE on the front panel of the Model 3934 controls whether an on-hook, off-hook or no supervision applied to a particular direction. The supervisory signaling is matched to the signaling selected via the INTERFACE switch. The supervisory signaling is independent to permit the splitting of the circuit for testing in one direction while maintaining supervisory control in the opposite direction.

A loop circuit ground start seizure capability is provided. Momentary activation of the switch labeled GND START on the front panel of the Model 3934 places a momentary ground on the ring lead when the module is set up in the LOOP INTERFACE configuration. This is the appropriate seizure signal used in "ground start" circuits.

The Model 3934 provides out-of-range measurement indications. An overrange is indicated by the largest permissible measurement value flashing on the display at a rate of 1 Hz. An underrange measurement is indicated by a minus (-) sign on the display.

The six send-leak networks identified in Figure 3-1 are provided. These are standardized combinations of resistance and capacitance that are shunted across the pulse-generating send circuit ahead of the incremental send-loop resistance. They simulate the tendency of ringers, ringing bridges, and other apparatus and equipments to reduce the break ratio in loop and B&G signaling systems. The networks are inserted on the send ciruit by setting the rotary switch on the front panel of the Model 3934 labeled SEND LEAK (DX BAL CAP).

Access to the circuit is possible in either a "thru" or "split" mode. A front panel mounted switch labeled MODE THRU/SPLIT selects the circuit access. In certain configurations the circuit access mode is "automatically" set by the Model 3934. Table 3-1 lists these conditions and the criterion for each automatic access mode. In circuits with separate signaling paths, such as E&M, SF and DF, each path can be controlled separately. This permits a circuit to be split in one direction while maintaining the circuit through in the opposite direction.

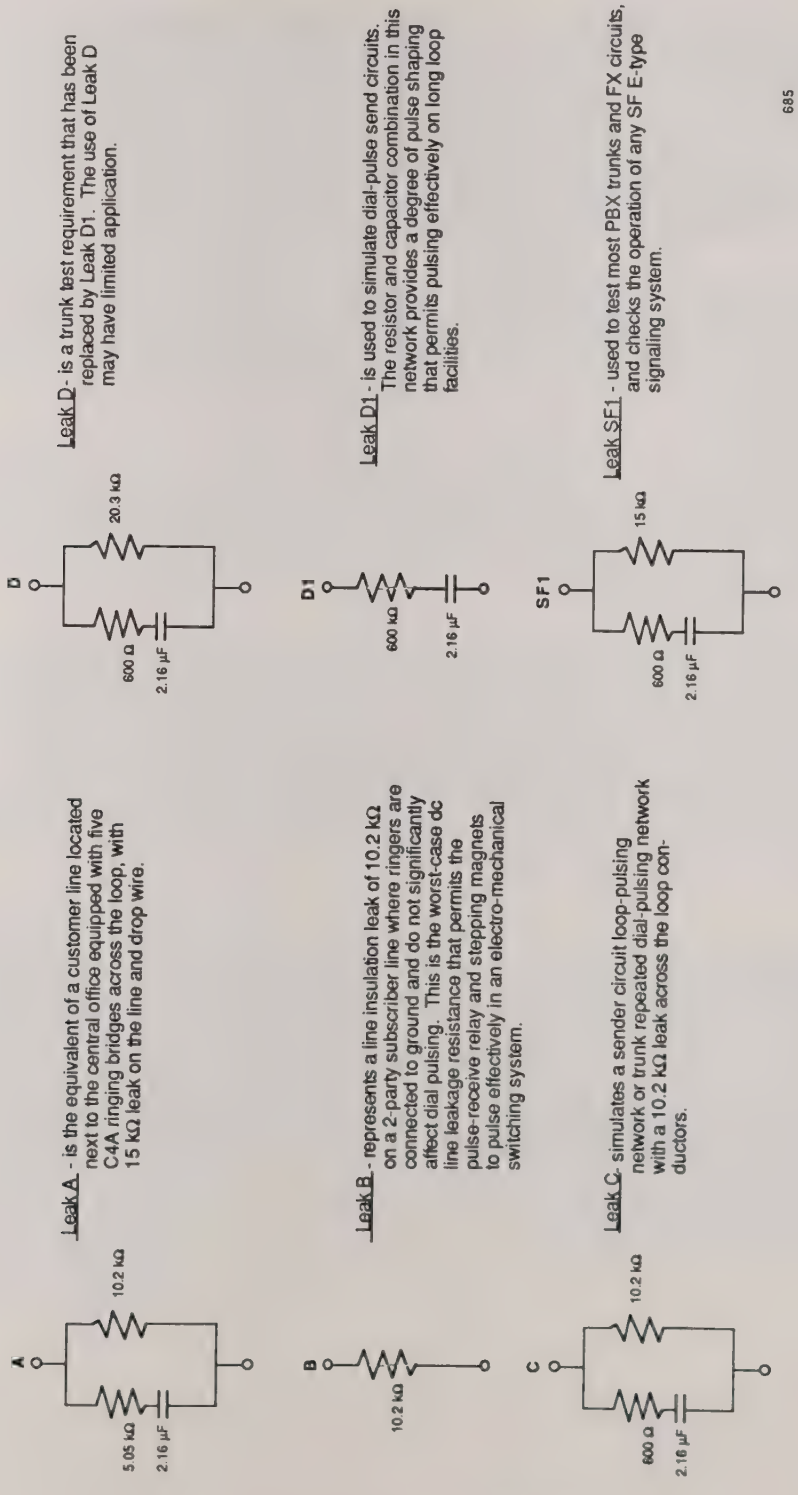

Leak A - is the equivalent of a customer line located next to the central office equipped with five C4A ringing bridges across the loop, with 15 kΩ leak on the line and drop wire.
A
10.2 kΩ
5.05 kΩ
2.16 µF
Leak B - represents a line insulation leak of 10.2 kΩ on a 2-party subscriber line where ringers are connected to ground and do not significantly affect dial pulsing. This is the worst-case dc line leakage resistance that permits the pulse-receive relay and stepping magnets to pulse effectively in an electro-mechanical switching system.
B
10.2 kΩ
Leak C - simulates a sender circuit loop-pulsing network or trunk repeated dial-pulsing network with a 10.2 kΩ leak across the loop conductors.
C
10.2 kΩ
600 Ω
2.16 µF
Leak D - is a trunk test requirement that has been replaced by Leak D1. The use of Leak D may have limited application.
D
20.3 kΩ
600 Ω
2.16 µF
Leak D1 - is used to simulate dial-pulse send circuits. The resistor and capacitor combination in this network provides a degree of pulse shaping that permits pulsing effectively on long loop facilities.
D1
600 kΩ
2.16 µF
Leak SF1 - used to test most PBX trunks and FX circuits, and checks the operation of any SF E-type signaling system.
SF1
15 kΩ
600 Ω
2.16 µF
685

Figure 3-1. Send-Leak Networks

TABLE 3-1. AUTOMATIC ACCESS CONDITIONS

Model 3934 Controling Conditions	Automatic Access Modes
Module turned off.[1]	THRU
EQPT/LINE, INTERFACE switch settings are the same.[2]	THRU
EQPT/LINE, INTERFACE switch settings are different.	SPLIT
If either PULSE TEST DIRECTION Switch setting is changed with LOOP or B&G INTERFACE settings on both switches.	THRU
Either the R TERM or A-RELAY terminations are inserted on the circuit via the FROM EQPT-LINE switch.	SPLIT
Supervision is sent in either the EQPT or LINE direction via the TO EQPT/LINE switch.	SPLIT

NOTES:

1. Circuitry in the Model 3934 defaults to a through (THRU) condition when power is turned off to the module. Any circuit connected to the INTERFACE jacks will pass through undisturbed with the module in this condition. (LED does not light to indicate this condition.)

2. Unit will "power-up" in the through (THRU) mode if this configuration exists at power-up. Changing the switches to the same settings automatically changes the access mode. (LED indicates the change in status.)

The measure circuit connects to the test circuit in one of three measurements configurations. These three configurations are: Bridge, Resistance Termination, and A-Relay. They are defined as follows:

BRIDGE - a high impedance bridging connection across the circuit that allows circuit monitoring without circuit disruption.

R TERM - a balanced, resistive and inductive termination matched to the specific requirements of the signaling system set on the INTERFACE switches.

A-RELAY - a termination which duplicates the action of a central office A-Relay to dial pulses. It consists of an actual A-Relay coil coupled with an electronic circuit that measures the loop current passing through the relay windings to obtain the measurement results. Measurements made to this termination are valid only for LOOP and B&G signaling systems. The Model 3934 prevents the use of this termination when testing other signaling systems.

The configurations are selectable via the front panel mounted switch labeled FROM, EQPT-LINE. Under certain operational conditions the Model 3934 will automatically set the configuration for the measure circuit. Table 3-2 is a list of these controlling conditions and the measure circuit configuration that will be set by a particular condition.

TABLE 3-2 . MEASURE CIRCUIT AUTOMATIC CONFIGURATIONS

Model 3934 Controlling Conditions	Automatic Configuration
At power-up of the module.	BRIDGE
If an INTERFACE switch setting is changes while the module is on.	BRIDGE
If either PULSE TEST DIRECTION switch setting is changed with LOOP or B&G INTERFACE settings on both switches.	BRIDGE
If either on-hook or off-hook supervision is sent in the direction corresponding to PULSE TEST DIRECTION, MEAS FROM switch setting, with either LOOP or B&G INTERFACE settings on both switches.	R TERM

The pulse generator operates in any of three modes. The switch labeled SEND on the front panel of the Model 3934 sets the pulsing mode. To activate the generator pulse circuit, off-hook supervision must be sent in the direction corresponding to the PULSE TEST DIRECTION, SEND TO switch setting. The three pulsing modes are defined as follows:

CONT PULSE - a continuous pulse train sent at the pulse speed and % break established as part of the operating parameters.

REP DIGIT - a digit entered via the SET keypad is pulsed continuously.

DIAL - digits entered via the SET keypad are outpulsed as they are entered. This dial pulse mode is used to perform address signaling.

The last displayed measurement is stored in memory as long as the module is turned on and no additional pulses are detected. The measurement is displayed for 5 seconds after the last received pulse. However, if no other pulses are detected, this measurement can be recalled from memory and displayed for another 5 second period by pressing the "C" key on the SET keypad. Pulse detection clears this measurement value from both the display and memory.

A PPS and % Bk measurement can be made and displayed after detection of only two pulses. Typically, the measurements are an average of the pulses detected between interdigital intervals, or the last eight pulses, if the pulses between intervals exceed eight. For measurement purposes any make period that exceeds 260 ms is considered as an interdigital interval, and is defined as the extended make period that distinguishes successive dial-pulse address digits.

First pulse distortion can be determined by comparing the % Bk measurements for the digits "2" and "0". The digit "2" consists of two pulses and the measurement is the % Bk between the first pulse and the second. The digit "0" consists of ten pulses and the % Bk measurement is the average of the last eight digits as described in paragraph 5.11. Because the % Bk measurement for the digit "0" excludes the first pulse, the difference between this measurement and the measurement for the digit "2" can be described as the first pulse distortion.

3.8 Operating Parameters Set-up Procedures

The Model 3934 has preset operating parameters that are required for proper operation of the module. The preset "default" operating parameters include: drop (EQPT) and line (LINE) side send and receive circuit transmission level points (TLP), send loop resistance, pulse speed in pulses per second (PPS), and the pulse percent break (% BK). Table 3-3 is a listing of these preset operating parameters and their values. These values are automatically set when the module is turned on. All these parameters are front panel programmable, however, for more flexible testing capabilities. The desired value of any parameter can be entered at the time of test. The changed values are retained while the Model 3934 remains turned on, and will be cleared from memory when the module is turned off. Also, only those parameters which affect a particular test measurement need to be set up at the time of test. Parameters that do not pertain to the test in progress can be left "as is" without effect on the operation of the module.

TABLE 3-3. MODEL 3934 PRESET OPERATING PARAMETERS

OPERATING PARAMETERS	VALUES
Send Pulse Speed	10.0 PPS
Send % Break	60% BK
Send-Loop Resistance	1.2 kΩ
TO LINE TLP	-16 dB
FROM LINE TLP	7 dB
TO EQPT TLP	7 dB
FROM EQPT TLP	-16 dB

Note: The Model 3934 defaults to these parameter values when turned on.

The seven operating parameters programmed into the Model 3934 are identified on the front panel rotary switch labeled DISPLAY. When the switch is rotated to the position corresponding to a particular parameter, that parameter is shown. Once displayed it can be changed by using the SET keypad. The operating parameters are identified as follows:

PPS - Sets the speed at which the Model 3934 will generate pulses. The speed is presented in pulses per second (PPS). The pulse speed can be set in a range from 5.5 to 23.0 PPS in 0.1 PPS steps.

% BREAK - Sets the ratio of break time to the total pulse period (make + break) time for pulses generated by the Model 3934. In dial-pulse signaling, break is defined as that portion of the signal in which the dialing contacts are open or broken. The value displayed is read directly as a percentage and is settable in a range from 20 to 80% in 1% increments.

LOOP/DX RES - Selects the send-loop incremental resistance value which will be inserted in the send circuit when pulsing a loop or B&G circuit. This resistive loading is used to simulate the resistance encountered in the loop between signaling units. This permits the testing of pulse receiving circuit performance under varied circuit loading conditions. Adding series resistance simulates longer loops and will tend to increase the % break of the pulses at the receiver. The Model 3934 displays the loop resistance in kΩs and has a adjustment range from 0.0 to 6.3 kΩ in 0.1 kΩ increments.

> **NOTE:** In units equipped with the DX Option .01 this is also the resistance added to the NEAR END DX send circuitry to provide a balanced output signal.

TO LINE TLP, FROM LINE TLP, TO EQPT TLP, FROM EQPT TLP - Set the transmission level points (TLP) for the send and receive circuit interfaces when testing SF and DF signaling. Sending and receiving at the proper level is critical when using inband signaling systems. These TLPs are settable, therefore, to insure the Model 3934 will operate properly in either a send or measure mode. The display shows the TLP in dB and has an adjustment range from +10 to -30 dB, in 1 dB increments.

3.8.1 Pulse Speed Set-up

STEP	ACTION	VERIFICATION
1	Push in the POWER switch on the Model 3901 Basic Unit to turn the unit on (if required).	The Basic Unit ON/OFF LED is on.
2	Push in the ON/OFF switch on the Model 3934 to turn the module on (if required).	The ON/OFF LED is on.
3	Rotate the DISPLAY switch knob to align the pointer with the PPS line.	The display shows 10.0 PPS.

STEP	ACTION	VERIFICATION
4	Push in the "C" key on the SET keypad. NOTE: The "C" key will clear whatever is displayed when in the parameter set up mode.	The display shows _ _. instead of the display from Step 3.
5	Push in the keys on the SET keypad to set the desired pulse speed. NOTE: Each underline symbol represents a digit to be entered. An entry must be made for each of three digits. Zeroes are entered for any digit not required for a particular pulse speed. The left most digit is always entered first with the digits to the right entered in succession. As an example, to set a pulse speed of 6.0 PPS; push the "0" key first, then the "6" key and then the "0" key again. The Model 3934 only allows entries that fall in the range from 5.5 PPS to 23.0 PPS.	The new pulse speed value is displayed.

3.8.2 Percent Break Set-up

STEP	ACTION	VERIFICATION
1	Push in the POWER switch on the Model 3901 Basic Unit to turn the unit on (if required).	The Basic Unit ON/OFF LED is on.
2	Push in the ON/OFF switch on the Model 3934 to turn the module on (if required).	The ON/OFF LED is on.
3	Rotate the DISPLAY switch knob to align the pointer with the % BREAK line.	The display shows 60% BK.

STEP	ACTION	VERIFICATION
4	Push in the "C" key on the SET keypad. NOTE: The "C" key will clear whatever is displayed when in the parameter set up mode.	The display shows _ _ instead of the display from Step 3.
5	Push in the keys on the SET keypad to set the desired % BK. NOTE: The underline symbols represent the two digits to be entered. An entry must be made for both digits. Enter the digit to the left first. The digit to the right must be entered even if it is a zero. The Model 3934 allows only entries that fall in the range from 30% to 80%.	The new % BK value is displayed.

3.8.3 Send-loop Resistance Set-up

STEP	ACTION	VERIFICATION
1	Push in the POWER switch on the Model 3901 Basic Unit to turn the unit on (If required).	The Basic Unit ON/OFF LED is on.
2	Push in the ON/OFF switch on the Model 3934 to turn the module on (If required).	The ON/OFF LED is on.
3	Rotate the DISPLAY switch knob to align the pointer with the LOOP/DX RES line.	The display shows 1.2 KΩ.

STEP	ACTION	VERIFICATION
4	Push in the "C" key on the SET keypad. NOTE: The "C" key will clear whatever is displayed when in the parameter set up mode.	The display shows _._ instead of the display from Step 3.
5	Push in the keys on the SET keypad to set the desired send-loop resistance. NOTE: The underline symbols represent the two digits to be entered. An entry must be made for both digits. The digit to the left of the decimal point is entered first. The digit to the right of the decimal point must be entered even if it is zero. The Model 3934 allows only entries that fall in the range from 0.0 KΩ to 6.3 KΩ.	The new send-loop resistance value is displayed.

3.8.4 Send/Receive Transmission Level Points (TLP)

STEP	ACTION	VERIFICATION
1	Push in the POWER switch on the Model 3901 Basic Unit to turn the unit on (if required).	The Basic Unit ON/OFF LED is on.
2	Push in the ON/OFF switch on the Model 3934 to turn the module on (if required).	The ON/OFF LED is on.
3	Rotate the DISPLAY switch knob to align the pointer with the line to the desired TLP setting: (TO LINE TLP, FROM LINE TLP, TO EQPT TLP, FROM EQPT TLP).	The display shows -16 db for the TO LINE TLP, and FROM EOPT TLP; and 7 dB for the FROM LINE TLP, and TO EOPT TLP.

STEP	ACTION	VERIFICATION
4	Push in the "C" key on the SET keypad. NOTE: The "C" key will clear whatever is displayed when in the parameter set up mode.	The display shows _ _ _ instead of the display from Step 3.
5	Push in the keys on the SET keypad to set the desired TLP. NOTE: Each underline symbol stands for a sign or digit to be entered. The left most entry will be a minus (-) sign, if required. The Model 3934 only allows entries that fall in the range from 10 dB to -30 dB. For TLPs in the range of 10 dB to 0 dB, the first key pushed will be either the "0" or "1" key. Entering a "1" first automatically sets a TLP of 10 dB. For TLPs from 0 to 9 dB, 0 is the first digit entered, followed by the desired TLP value. For TLPs in the range from 0 dB to -30 dB the "-" key must be pushed first. The digit just to the right of the "-" sign is entered next. An entry must be made for each possible digit, even if it is a 0.	The new TLP value is displayed.

3.9 Circuit Interface Set-Up Procedures

The Model 3934 connects to the signal circuit via four front panel mounted, WECO 310 type phone jacks. These jacks are labeled EQPT TO/FROM 2W, and LINE FROM/TO 2W. The labels identify the direction of connection to the circuit under test. The jacks labeled EQPT are connected to the terminal equipment or the drop side of the circuit and the LINE jacks are connected to the facility or line side of the circuit. When testing E&M signaling, the EQPT jacks connect the trunk circuit and the LINE jacks connect the signaling circuit.

Only a 2-wire connection is required for any of the dc pulse signaling systems: Loop, B&G, and E&M Types I, II, and III. The jacks labeled FROM EQPT 2W and TO LINE 2W provide these connections. Both SF and DF signaling are used on 4-wire voice frequency circuits. The Model 3934 provides the four jacks necessary for connection to the send and receive pairs of a 4-wire VF circuit. The FROM/TO labels indicate the direction of connection to the 4-wire VF circuit.

Each signaling method requires different interface circuitry. Since all the signaling systems are accessed via the same jacks, a means to connect the proper circuitry is provided. The two rotary switches labeled INTERFACE independently switch in the interface circuitry for the EQPT and LINE jacks. A line drawn on the front panel from the switch knob to the jacks, indicates the jacks controlled by that particular switch. Setting these INTERFACE switches for the appropriate signaling system connects the proper interface circuitry within the Model 3934. Figure 3-2 identifies the dc pulse signaling interfaces provided by the Model 3934. Both the receiving and sending circuit terminations for loop and B&G signaling systems are provided. Interfaces that are the equivalent of E&M Types I, II, and III trunk and signaling circuits are also provided. In E&M Types II and III, the battery and ground functions are provided by the Model 3934 so there is no need to access the SG and SB leads when testing these systems.

The SF and DF signaling interfaces are properly balanced VF circuit terminations. Both send and receive connections can be adjusted to the proper circuit TLPs at the point of test. The high impedance (30 kΩ) bridging interface mode allows nonintrusive access to the test circuit for monitoring while also preventing service interruption on active circuits.

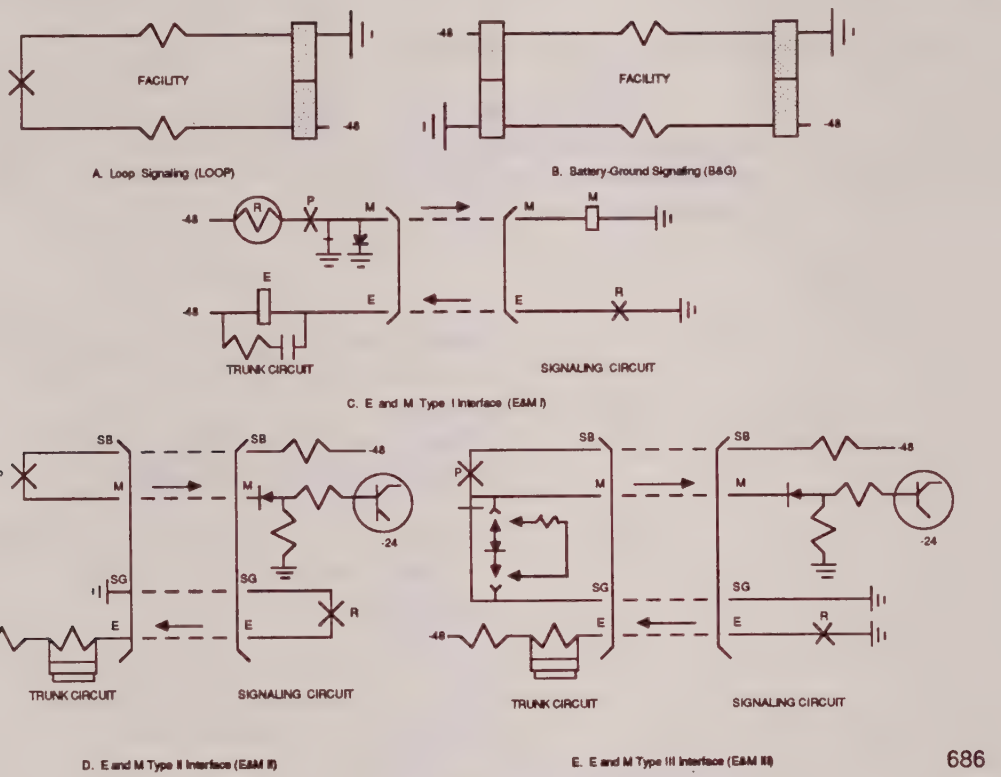


Figure 3-2. DC Pulse Signaling Interfaces

Independent control of the EQPT/LINE interface jacks increases the flexibility of the Model 3934 in the performance of testing at various points on the circuit. The capability to simultaneously interface two different signaling systems permits the use of the Model 3934 in testing signal conversion equipment. When testing signal conversion equipment, the Model 3934 splits the circuit, performs testing in one direction while providing a termination and supervisory control in the opposite direction using a completely different signaling method.

To set up the typical signal circuit interfaces with the Model 3934 perform the following:

> **NOTE:** Use only WECO 310 type phone plugs or equivalent for the connections to the INTERFACE jacks on the Model 3934. Use of other types of plugs may deform the jacks and cause equipment malfunction.

3.9.1 Loop Signaling Circuit Interface

NOTE: For proper operation of the pulse receiving circuitry in the Model 3934, office battery or -48V dc must be on the ring conductor of the test circuit and ground on the tip conductor.

STEP	ACTION
1	Rotate the LINE INTERFACE switch knob to align the pointer with the LOOP line.
2	Rotate the EQPT INTERFACE switch knob to align the pointer with the LOOP line.
3	Connect a WECO 310 type cable from the facility or line side of the VF circuit to the TO LINE 2W jack on the Model 3934.
4	Connect a WECO 310 type cable from the drop or terminal side of the VF circuit to the FROM EQPT 2W jack on the Model 3934.

3.9.2 Battery and Ground Signaling Circuit Interface

NOTE: For proper operation of the pulse receiving circuitry in the Model 3934, office battery or -48V dc must be on the ring conductor of the test circuit and ground on the tip conductor.

STEP	ACTION
1	Rotate the LINE INTERFACE switch knob to align the pointer with the B&G line.
2	Rotate the EQPT INTERFACE switch knob to align the pointer with the B&G line.
3	Connect a WECO 310 type cable from the facility or line side of the VF circuit to the TO LINE 2W jack on the Model 3934.

STEP	ACTION
4	Connect a WECO 310 type cable from the drop or terminal side of the VF circuit to the FROM EQPT 2W jack on the Model 3934.

3.9.3 E&M Signaling Types I, II and III Circuit Interface

NOTE: For proper operation of the Model 3934 the E&M, E lead must be the tip conductor and the M lead the ring conductor of the signaling circuit.

STEP	ACTION
1	Determine the type of E&M signaling used on the circuit to be tested.
2	Rotate the LINE INTERFACE switch knob to align the pointer with the E&M line: E&M I, E&M II, E&M III, that matches the type signaling determined in Step 1.
3	Rotate the EQPT INTERFACE switch knob to align the pointer with the same E&M setting selected in Step 2.

NOTE: The EQPT and LINE INTERFACE switches must be set to the same E&M type unless testing signal conversion equipment.

4	Connect a WECO 310 type cable from the E&M signaling circuit or line to the TO LINE 2W jack on the Model 3934.

NOTE: There is no requirement to interface the SG and SB leads when testing E&M II and III type circuits. The Model 3934 provides all battery and ground functions if a -48V input has been provided in accordance with Section B, -48 VDC INPUT CONNECTIONS.

STEP	ACTION
5	Connect a WECO 310 type cable from the E&M channel, trunk or drop to the FROM EQPT 2W jack on the Model 3934.

3.9.4 SF and DF Signaling Circuit Interface

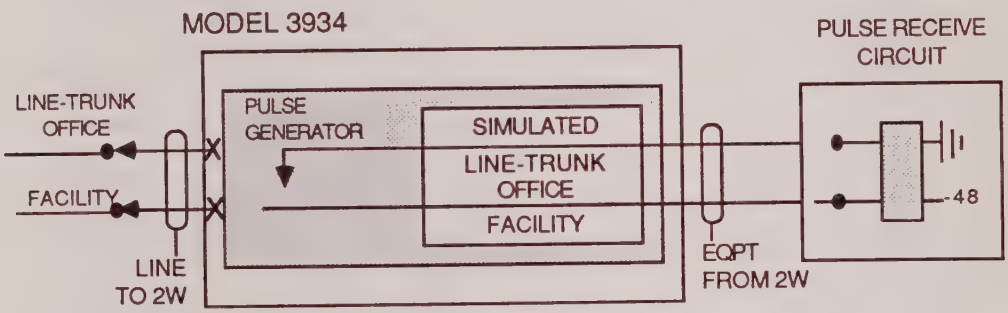
STEP	ACTION
1	Determine whether SF or DF signaling is used on the circuit to be tested.
2	Rotate the LINE INTERFACE switch knob to align the pointer with either the SF or DF line, depending on the signaling method determined in Step 1.
3	Rotate the EQPT INTERFACE switch knob to align the pointer with the setting selected in Step 2.

NOTE: Both the EQPT and LINE INTERFACE switches must be set to the same position if the EQPT and LINE jacks are connected to the VF leads of the circuit under test.

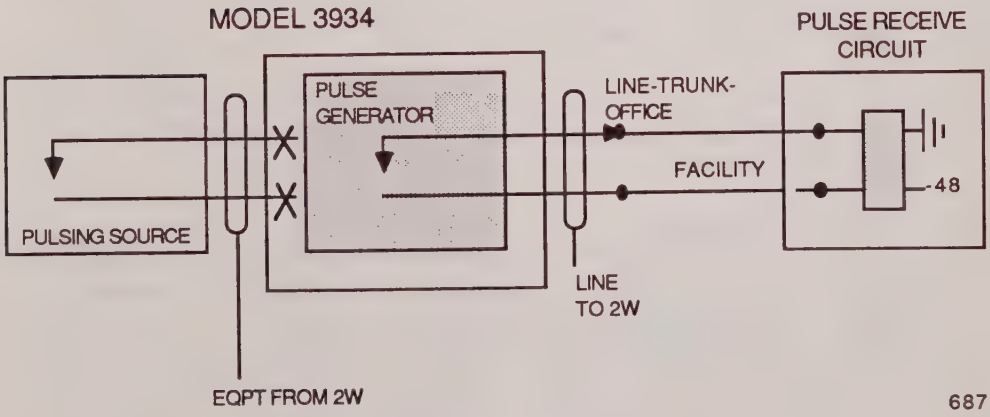
4	Connect a WECO 310 type cable from the facility or line side, send pair of the VF circuit to the TO LINE 2W jack on the Model 3934.
5	Connect a WECO 310 type cable from the facility or line side, receive pair of the VF circuit to the FROM LINE jack on the Model 3934.
6	Connect a WECO 310 type cable from the drop or terminal side, send pair of the VF circuit to the FROM EQPT 2W jack on the Model 3934.
7	Connect a WECO 310 type cable from the drop or terminal side, receive pair of the VF circuit to the TO EQPT jack on the Model 3934.

3.10 Loop Signaling - DC Pulse Measurement

The Model 3934 supports dc pulse measurements in loop signaling systems in either send or measurement operational modes. Figure 3-3 identifies two typical configurations for the Model 3934 in the send mode. Figure 3-4 identifies three typical measurement configurations for the Model 3934. These figures are presented as "typical" configurations because the Model 3934 is fully capable of providing all send and measure functions via either the EQPT or LINE jack and therefore not limited to those depicted. The figures are the basis for the following loop pulse measurement procedures and establish the fundamental procedures for operating the Model 3934 in either the send or measure mode.



A. Near-End Test (Send To Eqpt)



B. Far-End Test (Send To Line)

Figure 3-3. Loop Signaling Send Mode - DC Pulse Measurement

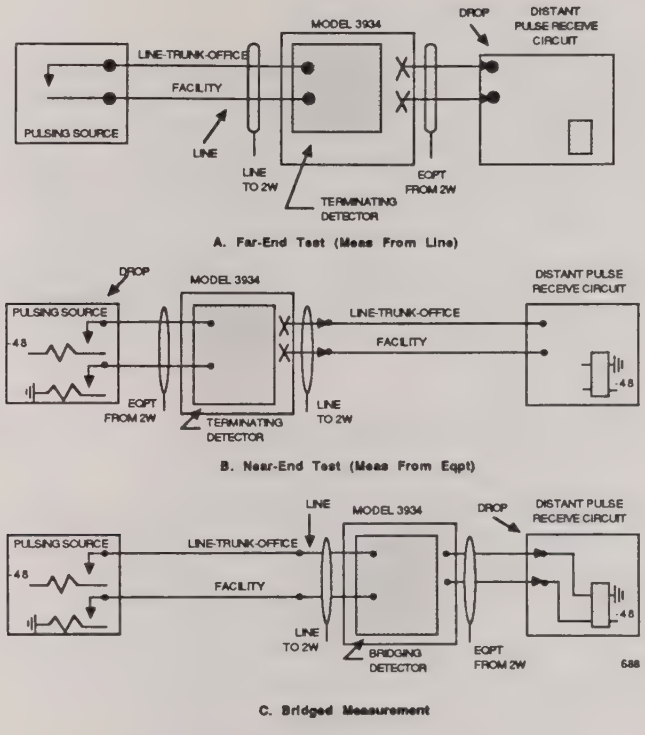


Figure 3-4. Loop Signaling Measurement Mode - DC Pulse Measurement

3.10.1 Near End Test - Send Mode

NOTE: Refer to Figure 3-5 for the Model 3934 configuration described in the following setup procedures.

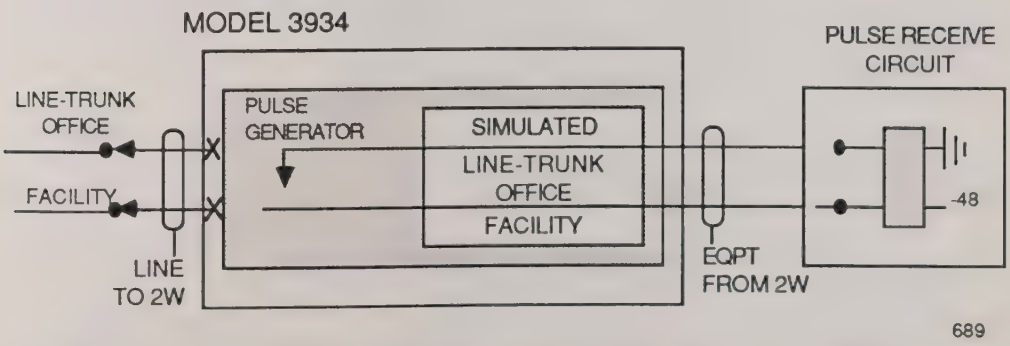


Figure 3-5. Loop Signaling Send Mode - Near End Test (Send to EQPT)

STEP	ACTION	VERIFICATION
1	Verify the -48V dc input is connected.	
2	Push in the ON/OFF switch on the Model 3934 to turn the module on (if required).	The ON/OFF LED is on.
3	Set the pulse speed (PPS) following the procedures in Section 3.8 (if required). **NOTE:** The pulse speed is automatically set to 10 PPS at "power up" of the module.	
4	Set the % BREAK following the procedures in Section 3.8 (if required). **NOTE:** The % Bk is automatically set to 60% Bk at "power up" of the module.	
5	Set the send-loop resistance (LOOP/DX RES) following the procedures in Section 3.8 (if required). **NOTE:** The send-loop resistance is automatically set at 1.2 kΩ at "power up" of the module.	
6	Rotate the DISPLAY switch knob to align the pointer with the MEAS line.	

STEP	ACTION	VERIFICATION
7	Rotate the SEND LEAK (DX BAL CAP) switch knob to align the pointer to the desired leak network position (if required). **NOTE:** Refer to Figure 3-1 for further details on the available leak networks.	
8	Set the PULSE TEST DIRECTION, SEND TO switch to the EQPT position.	
9	Set the PULSE TEST DIRECTION, MEAS FROM switch to the LINE position. **NOTE:** When testing loop signaling the PULSE TEST DIRECTION, SEND TO and MEAS FROM switches must be set in opposite directions. Setting both switches in the same direction causes an open circuit at the interface jack opposite to the switch settings. This prevents through access to the circuit and does not allow supervision to be sent in the direction of the open circuit.	
10	Set up the LOOP interface following the procedures in Section 3.9.1.	
11	Verify the circuit is idle. **NOTE:** If off-hook supervision is detected and the circuit is determined to be in use, the test procedure would be halted.	The EQPT AND LINE, INCOMING ON HOOK LEDs are on if the circuit is idle. If the LEDs are off, it indicates off-hook super vision is being received from the direction indicated.

STEP	ACTION	VERIFICATION
12	Toggle the TO, EQPT-LINE switch towards the EQPT label to send off-hook supervision (if the circuit is idle). **NOTE:** This seizes the circuit in the direction connected to the EQPT INTERFACE jack (for loop start circuits). Perform Step 13 for ground start circuits.	The EQPT, OFF HOOK LED is on. The SPLIT MODE LED is on. The EQPT, INCOMING ON HOOK LED is off.
13	Toggle the GND START switch to seize the circuit (ground start circuits only). **NOTE:** This places a momentary ground on the ring lead to provide a seizure signal for a ground start circuit.	Indications are as described in Step 12.
14	Toggle the TO, EQPT-LINE switch towards the LINE label to send off-hook supervision (if required). **NOTE:** This will "busy out" the circuit in the direction connected to the LINE INTERFACE jack.	The LINE, OFF HOOK LED is on. The LINE, INCOMING ON HOOK LED is off.
15	Toggle the SEND switch in the upward direction to the desired pulsing mode to turn the pulse generator on. If the DIAL mode is selected key digits in from the keyboard. There is no limit as to the number of digits selected. If the REP DIGIT mode is selected key	The LED for the selected pulsing send mode is on. The EQPT, ON HOOK and OFF HOOK LEDs are flashing alternately.

STEP	ACTION	VERIFICATION
	in a single digit from the keyboard. This digit will be continuously transmitted using a 700 ms interdigit interval.	
16	Toggle the SEND switch in the downward direction to turn the pulse generator off. **NOTE:** Off-hook supervision must be sent in the desired pulsing direction for the pulse generator to operate.	The SEND mode LED labeled "OFF" is on.
17	Toggle the MODE, THRU-SPLIT switch towards the THRU label (if testing is complete). **NOTE:** This clears any supervisory signaling being sent by the Model 3934.	The THRU MODE LED is on. The EQPT and LINE, BRIDGE LEDs are on. The ON/OFF LED is on.

3.10.2 Far End Test - Send Mode

NOTE: Refer to Figure 3-6 for the Model 3934 configuration described in the following setup procedures.

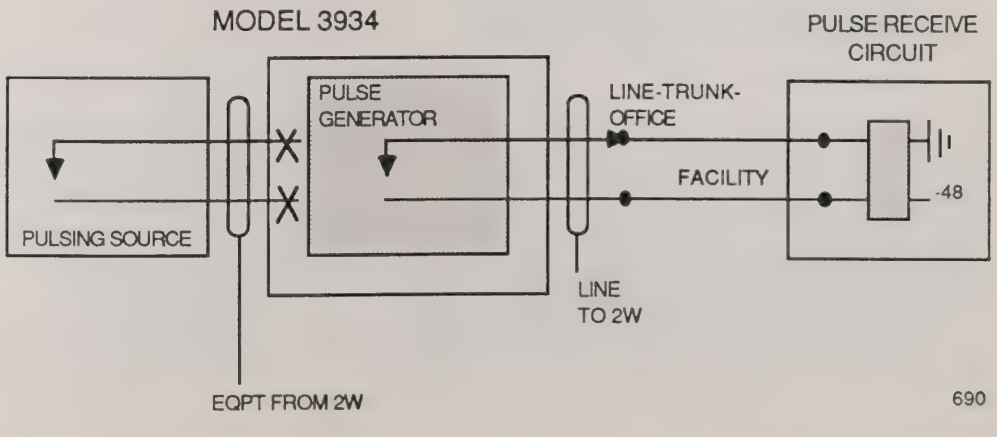


Figure 3-6. Loop Signaling Send Mode - Far End Test (Send to Line)

STEP	ACTION	VERIFICATION
1	Verify the -48 VDC input is connected.	
2	Push in the ON/OFF switch on the Model 3934 to turn the module on (if required).	The ON/OFF LED is on.
3	Set the pulse speed (PPS) following the procedures in Section 3.8 (if required). **NOTE:** The pulse speed is automatically set to 10 PPS at "power up" of the module.	
4	Set the % BREAK following the procedures in Section 3.8 (if required). **NOTE:** The % Bk is automatically set to 60% Bk at "power up" of the module.	
5	Set the send-loop resistance (LOOP/DX RES) following the procedures in Section 3.8 (if required). **NOTE:** The send-loop resistance is automatically set at 1.2 kΩ at "power-up" of the module. If no loop-resistance is desired, set the value 0.0.	
6	Rotate the DISPLAY switch knob to align the pointer with the MEAS line.	

STEP	ACTION	VERIFICATION
7	Set the PULSE TEST DIRECTION, SEND TO switch to the LINE position.	
8	Set the PULSE TEST DIRECTION, MEAS FROM switch to the EQPT position. NOTE: When testing loop signaling, the PULSE TEST DIRECTION, SEND TO and MEAS FROM switches must be set in opposite directions. Setting both switches in the same direction causes an open circuit at the interface jack opposite to the switch settings. This prevents through access to the circuit and does not allow supervision to be sent in the direction of the open circuit.	
9	Set up the LOOP interface following the procedures in Section 3.9.1. Verify the circuit is idle.	
10	NOTE: If off-hook supervision is detected and the circuit is determined to be in use the test would be halted.	The EQPT and LINE, INCOMING ON HOOK LEDs are on if the ciruit is idle. If the LEDs are off, it indicates off-hook supervision is being received from the direction indicated.
11	Toggle the TO, EQPT-LINE switch towards the LINE label to send off-hook supervision (if circuit is idle).	The LINE, OFF HOOK LED is on. The SPLIT MODE LED is on. The LINE, INCOMING ON HOOK LED is off.

STEP	ACTION	VERIFICATION
	NOTE: This will seize the circuit in the direction connected to the LINE INTERFACE jack (for loop start circuits) perform Step 12 for ground start circuits.	
12	Toggle the GND START switch to seize the circuit (ground start circuit only). **NOTE:** This places a momentary ground on the ring lead to provide a seizure signal for a ground start circuit.	Indications are as described in Step 11.
13	Toggle the TO, EQPT-LINE switch towards the EQPT label to send off-hook supervision (if required). **NOTE:** This will "busy out" the circuit in the direction connected to the EQPT INTERFACE jack.	The EQPT, OFF HOOK LED is on. The EQPT, INCOMING ON HOOK LED is off.
14	Toggle the SEND switch in the upward direction to the desired pulsing mode to turn the pulse generator on. **NOTE:** Off-hook super vision must be sent in the desired pulsing direction for the pulse generator to operate.	The LED for the selected pulsing mode is on. The LINE, ON HOOK and OFF HOOK LEDs are flashing alternately.
15	Toggle the SEND switch in the downward direction to turn the pulse generator off.	The SEND mode LED labeled "OFF" is on.

STEP	ACTION	VERIFICATION
16	Toggle the MODE, THRU-SPLIT switch towards the THRU label (if testing is complete). NOTE: This clears any supervisory signaling being sent by the Model 3934.	The THRU MODE LED is on. The EQPT and LINE, BRIDGE LEDs are on.

3.10.3 Far End Test - Measure Mode

NOTE: Refer to Figure 3-7 for the Model 3934 configuration described in the following setup procedures.

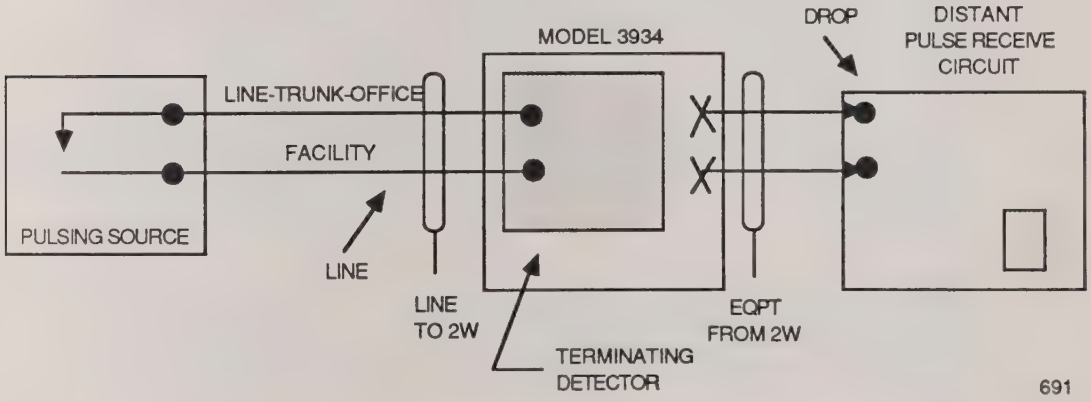


Figure 3-7. Loop Signaling Measurement Mode - Far End Test (Measurement Line)

STEP	ACTION	VERIFICATION
1	Verify the -48 VDC input is connected.	
2	Push in the ON/OFF switch on the Model 3934 to turn the module on (if required).	The ON/OFF LED is on.
3	Rotate the DISPLAY switch knob to align the pointer with the MEAS line (if required).	

STEP	ACTION	VERIFICATION
4	Set the PULSE TEST DIRECTION, MEAS FROM switch to the LINE position.	
5	Set the PULSE TEST DIRECTION, SEND TO switch to the EQPT position. **NOTE:** When testing loop signaling the PULSE TEST DIRECTION, SEND TO and MEAS FROM switches must be set in opposite directions. Setting both switches in the same direction causes an open circuit at the interface jack opposite to the switch settings. This prevents through access to the circuit and does not allow supervision to be sent in the direction of the open circuit.	
6	Set up the LOOP interface following the procedures in Section 3.9.1.	
7	Verify the circuit is idle. **NOTE:** If off-hook supervision is detected and the circuit is determined to be in use, the test may be halted.	The EQPT and LINE, INCOMING ON HOOK LEDs are on if the circuit is idle. If the LEDs are off, it indicates off-hook supervision is being received from the direction indicated.
8	Toggle the FROM, EQPT-LINE switch towards the LINE label to set up the desired measurement termination (if circuit is idle). **NOTE:** This will send off-hook supervision in the direction connected to the LINE INTERFACE jack.	The LINE, OFF HOOK LED is on. The LINE, R TERM or LINE, A-RELAY LED is on. The SPLIT MODE LED is on. The LINE, INCOMING ON HOOK is off.

STEP	ACTION	VERIFICATION
9	Toggle the TO, EQPT-LINE switch towards the EQPT label to send off-hook supervision (if required). NOTE: This will "busy out" the circuit in the direction connected to the EQPT INTERFACE jack.	The EQPT, OFF HOOK LED is on. The EQPT, INCOMING ON HOOK LED is off.
10	Take the desired measurements. NOTE: The readings are displayed for 5 seconds after the last pulse is received. Pushing the "C" key on the SET keypad will recall the last measurement for another 5 seconds, if no additional pulses are detected. Detection of pulses clears the previous measurement from memory.	The pulse speed (PPS) and % break (% BK) are displayed.
11	Toggle the MODE, THRU-SPLIT switch towards the THRU label (if testing is complete). NOTE: This clear any supervisory signaling being sent by the Model 3934 and sets up the configuration shown in Figure 3-8.	The THRU MODE LED is on. The EQPT and LINE, BRIDGE LEDs are on.

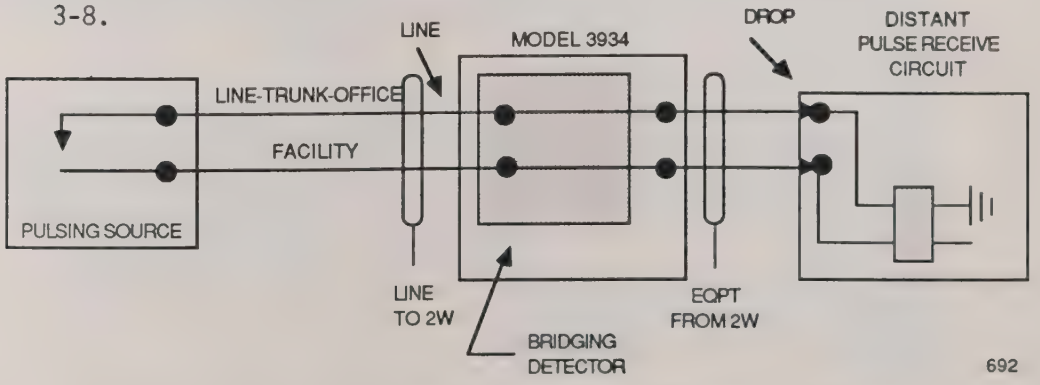


Figure 3-8. Loop Signaling Measurement Mode - Bridged

3.10.4 Near End Test - Measure Mode

NOTE: Refer to Figure 3-9 for the Model 3934 configuration described in the following set-up procedure.

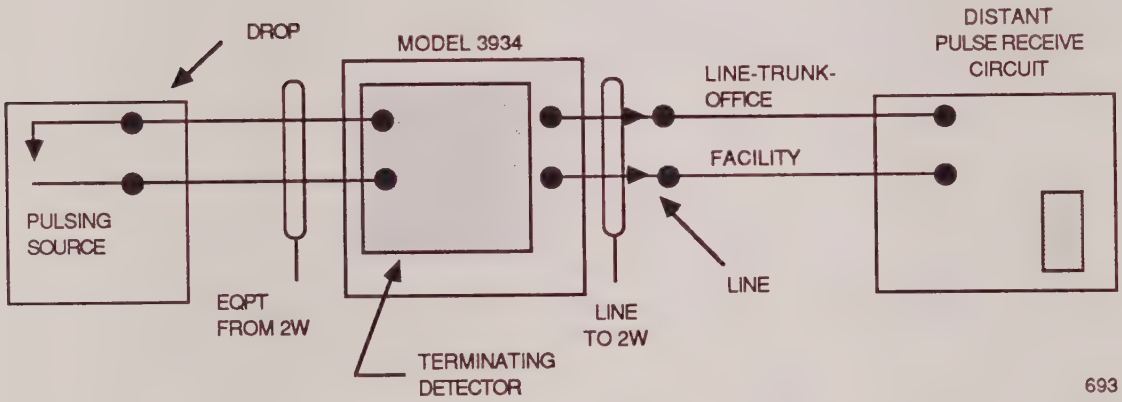


Figure 3-9. Loop Signaling Measurement Mode - Near End Test (Meas From EQPT)

STEP	ACTION	VERIFICATION
1	Verify the -48 VDC input is connected.	
2	Push in the ON/OFF switch on the Model 3934 to turn the module on (if required).	The ON/OFF LED is on.
3	Rotate the DISPLAY switch knob to align the pointer with the MEAS line (if required).	
4	Set the PULSE TEST DIRECTION, MEAS FROM switch to the EQPT position.	

STEP	ACTION	VERIFICATION
5	Set the PULSE TEST DIRECTION, SEND TO switch to the LINE position. **NOTE:** When testing loop signaling the PULSE TEST DIRECTION, SEND TO and MEAS FROM switches must be set in opposite directions. Setting both switches in the same direction causes an open circuit at the interface jack opposite to the switch settings. This prevents through access to the circuit and does not allow supervision to be sent in the direction of the open circuit.	
6	Set up the LOOP interface following the procedures in Section 3.9.1.	
7	Verify the circuit is idle. **NOTE:** If off-hook supervision is detected and the circuit is determined to be in use, the test may be halted.	The EQPT and LINE, INCOMING ON HOOK LEDs are on if the circuit is idle. If the LEDs are off, it indicates off-hook supervision is being received from the direction indicated.
8	Toggle the FROM, EQPT-LINE switch towards the EQPT label to set up the desired measurement termination (if circuit is idle). **NOTE:** This will send off-hook supervision in the direction connected to the EQPT INTERFACE jack.	The EQPT, OFF HOOK LED is on. The EQPT, R TERM or EQPT, A-RELAY LED is on. The SPLIT MODE LED is on. The EQPT, INCOMING ON HOOK is off. The LINE, OFF HOOK LED is on. The LINE, INCOMING ON HOOK LED is off.
9	Toggle the TO, EQPT-LINE switch towards the LINE label to send off-hook supervision (if required).	

STEP	ACTION	VERIFICATION
	NOTE: This will "busy out" the circuit in the direction connected to the LINE INTERFACE jack.	
10	Take the desired measurements.	The pulse speed (PPS) and % break (% BK) are displayed.
	NOTE: The readings are displayed for 5 seconds after the last pulse is received. Pushing the "C" key on the SET keypad will recall the last measurement for another 5 seconds, if no additional pulses are detected. Detection of pulses clears the previous measurement from memory.	
11	Toggle the MODE, THRU-SPLIT switch towards the THRU label (if testing is complete).	The THRU MODE LED is on. The EQPT and LINE, BRIDGE LEDs are on.
	NOTE: This clears any supervisory signaling being sent by the Model 3934.	

3.11 Battery and Ground (B&G) Signaling - DC Pulse Measurement

The Model 3934 supports dc pulse measurements in B&G signaling systems in either send or measurement operational modes. Figure 3-10 identifies two typical configurations for the Model 3934 in the send mode. Figure 3-11 identifies three typical measurement configurations for the Model 3934. These figures are presented as "typical" configurations because the Model 3934 is fully capable of providing all send and measure functions via either the EQPT or LINE jack and therefore not limited to those depicted. The figures are the basis for the following B&G pulse measurement procedures and establish the fundamental procedures for operating the Model 3934 in either the send or measure mode.

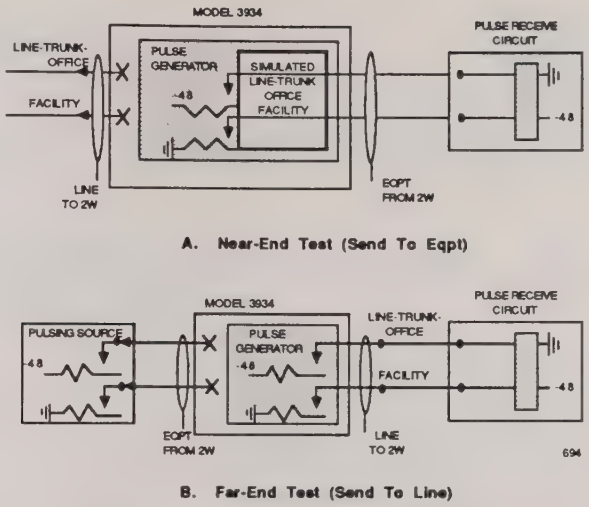


Figure 3-10. Battery and Ground Signaling Send Mode - DC Pulse Measurement

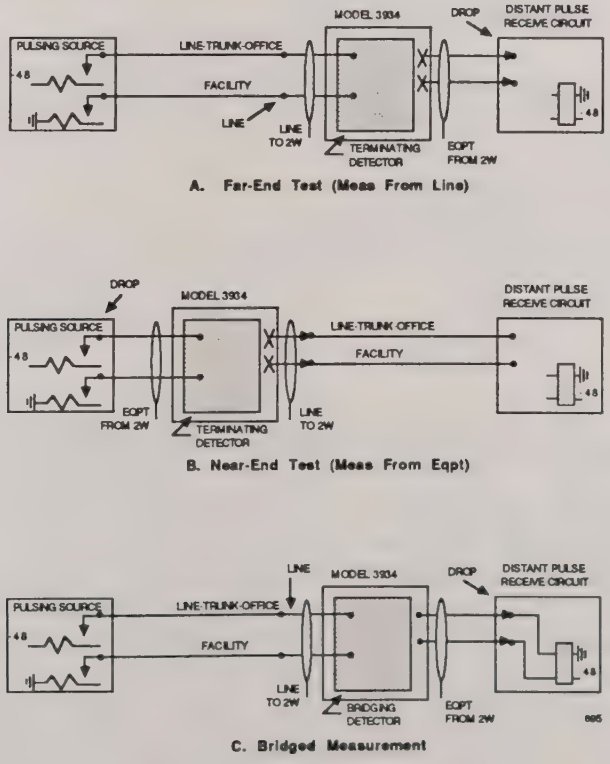


Figure 3-11. Battery and Ground Signaling Measurement Mode - DC Pulse Measurement

3.11.1 Near End Test - Send Mode

STEP	ACTION	VERIFICATION

NOTE: Refer to Figure 3-12 for the Model 3934 configuration described in the following setup procedures.

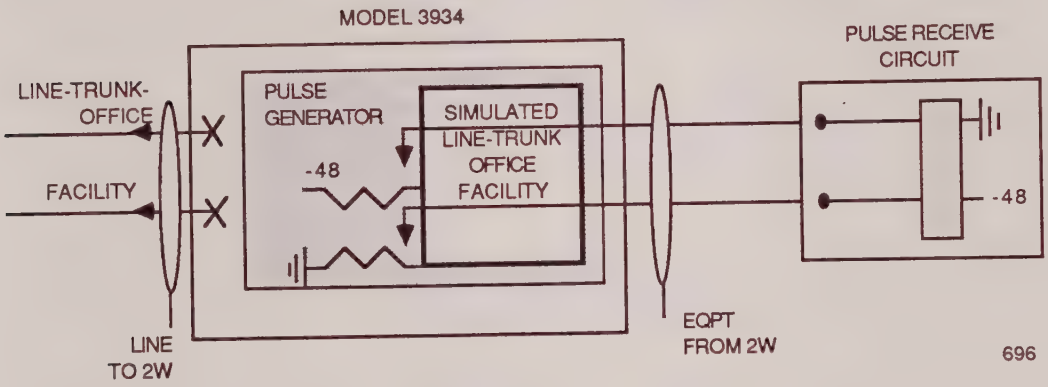


Figure 3-12. Battery and Ground Signaling Send Mode - Near End Test (Send to Line)

STEP	ACTION	VERIFICATION
1	Verify the -48 VDC input is connected.	
2	Push in the ON/OFF switch on the Model 3934 to turn the module on (if required).	The ON/OFF LED is on.
3	Set the pulse speed (PPS) following the procedures in Section 3.8.1 (if required). NOTE: The pulse speed is automatically set to 10 PPS at "power up" of the module.	

STEP	ACTION	VERIFICATION
4	Set the % BREAK following the procedures in Section 3.8.2 (if required). NOTE: The % Bk is automatically set to 60% Bk at "power up" of the module.	
5	Set the send-loop resistance (LOOP/DX RES) following the procedures in Section 3.8.3 (if required). NOTE: The send-loop resistance is automatically set at 1.2 kΩ at "power up" of the module.	
6	Rotate the DISPLAY switch knob to align the pointer with the MEAS line (if required).	
7	Rotate the SEND LEAK (DX BAL CAP) switch knob to align the pointer with the desired leak network line (if required). NOTE: Refer to Figure 3-1 for further details on the available leak networks.	
8	Set the PULSE TEST DIRECTION, SEND TO switch to the EQPT postion.	

STEP	ACTION	VERIFICATION
9	Set the PULSE TEST DIRECTION, MEAS FROM switch to the LINE position. **NOTE:** When testing B&G signaling the PULSE TEST DIRECTION, SEND TO and MEAS FROM switches must be set in opposite directions. Setting both switches in the same direction causes an open circuit at the interface jack opposite to the switch settings. This prevents through access to the circuit and does not allow supervision to be sent in the direction of the open circuit.	
10	Set up the B&G interface following the procedures in Section 3.9.2.	
11	Verify the circuit is idle. **NOTE:** If off-hook supervision is detected and the circuit is determined to be in use, the test procedure would be halted.	The EQPT and LINE, INCOMING ON HOOK LEDs are on if the circuit is idle. If the LEDs are off, it indicates off-hook supervision is being received from the direction indicated.
12	Toggle the TO, EQPT-LINE switch towards the EQPT label to send off-hook supervision (if the circuit is idle). **NOTE:** This will seize the circuit in the direction connected to the EQPT INTERFACE jack.	The EQPT, OFF HOOK LED is on. The SPLIT MODE LED is on. The EQPT, INCOMING ON HOOK LED is off.

STEP	ACTION	VERIFICATION
13	Toggle the TO, EQPT-LINE switch towards the LINE label to send off-hook supervision (if required). NOTE: This will "busy out" the circuit in the direction connected to the LINE INTERFACE jack.	The LINE, OFF HOOK LED is on. The LINE, INCOMING ON HOOK LED is off.
14	Toggle the SEND switch in the upward direction to the desired pulsing mode to turn the pulse generator on. NOTE: Off-hook supervision must be sent in the desired pulsing direction for the pulse generator to operate.	The LED for the selected pulsing SEND mode is on. The EQPT, ON HOOK and OFF HOOK LEDs are flashing alternately.
15	Toggle the SEND switch in the downward direction to turn the pulse generator off.	The SEND mode LED labeled "OFF" is on.
16	Toggle the MODE, THRU-SPLIT switch towards the THRU label (if testing is complete). NOTE: This clears any supervisory signaling being sent by the Model 3934.	The THRU MODE LED is on. The EQPT and LINE, BRIDGE LEDs are on.

3.11.2 Far End Test - Send Mode

NOTE: Refer to Figure 3-13 for the Model 3934 configuration described in the following setup procedures.

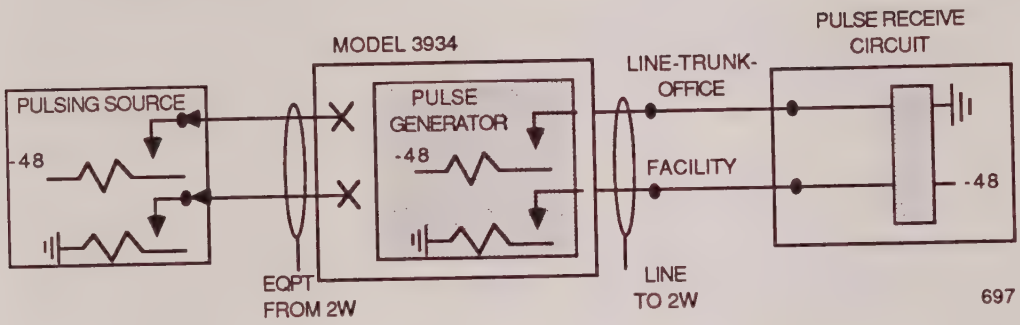


Figure 3-12. Battery and Ground Signaling Send Mode - Far End Test (Send to Line)

STEP	ACTION	VERIFICATION
1	Verify the -48 VDC input is connected.	
2	Push in the ON/OFF switch on the Model 3934 to turn the module on (if required).	The ON/OFF LED is on.
3	Set the pulse speed (PPS) following the procedures in Section 3.8.1 (if required). NOTE: The pulse speed is automatically set to 10 PPS at "power up" of the module.	
4	Set the % BREAK following the procedures in Section 3.8.2 (if required). NOTE: The % Bk is automatically set to 60% Bk at "power up" of the module.	

STEP	ACTION	VERIFICATION
5	Set the send-loop resistance (LOOP/DX RES) following the procedures in Section 3.8.3 (if required). **NOTE:** The send-loop resistance is automatically set at 1.2kΩ at "power up" of the module. If no loop-resistance is desired, set the value to 0.0.	
6	Rotate the DISPLAY switch knob to align the pointer with the MEAS line (if required).	
7	Set the PULSE TEST DIRECTION, SEND TO switch to the LINE position.	
8	Set the PULSE TEST DIRECTION, MEAS FROM switch to the EQPT position. **NOTE:** When testing B&G signaling the PULSE TEST DIRECTION SEND TO and MEAS FROM switches must be set in opposite directions. Setting both switches in the same direction causes an open circuit at the interface jack opposite to the switch settings. This prevents through access to the circuit and does not allow supervision to be sent in the direction of the open circuit.	
9	Set up the B&G interface following the procedures in Section 3.9.2.	

STEP	ACTION	VERIFICATION
10	Verify the circuit is idle. **NOTE:** If off-hook supervision is detected and the circuit is determined to be in use, the test would be halted.	The EQPT and LINE, INCOMING ON HOOK LEDs are on if the circuit is idle. If the LEDs are off, it indicates off-hook supervision is being received from the direction indicated.
11	Toggle the TO, EQPT-LINE switch towards the LINE label to send off-hook supervision (if the circuit is idle). **NOTE:** This will seize the circuit in the direction connected to the LINE INTERFACE jack.	The LINE, OFF HOOK LED is on. The SPLIT MODE LED is on. The LINE, INCOMING ON HOOK LED is off. The EQPT, OFF HOOK LED is on. The EQPT, INCOMING ON HOOK LED is off.
12	Toggle the TO, EQPT-LINE switch towards the EQPT label to send off-hook supervision (if required). **NOTE:** This will "busy out" the circuit in the direction connected to the EQPT INTERFACE jack.	
13	Toggle the SEND switch in the upward direction to the desired pulsing mode to turn the pulse generator on. **NOTE:** Off-hook supervision must be sent in the desired pulsing direction for the pulse generator to operate.	The LED for the selected pulsing mode is on. The LINE, ON HOOK and OFF HOOK LEDs are flashing alternately.
14	Toggle the SEND switch in the downward direction to turn the pulse generator off.	The SEND mode LED labeled "OFF" is on.

STEP	ACTION	VERIFICATION
15	Toggle the MODE, THRU-SPLIT switch towards the THRU label (if testing is complete). NOTE: This clears any supervisory signaling being sent by the Model 3934.	The THRU MODE LED is on. The EQPT and LINE, BRIDGE LEDs are on.

3.11.3 Far End Test - Measurement Mode

NOTE: Refer to Figure 3-14 for the Model 3934 configuration described in the following setup procedures.

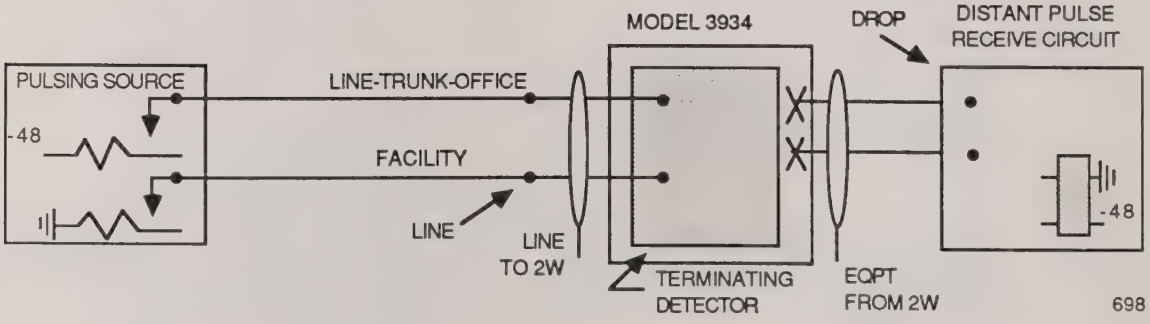


Figure 3-14. Battery and Ground Signaling Measurement Mode - Far End Test (Meas From Line)

STEP	ACTION	VERIFICATION
1	Verify the -48 VDC input is connected.	
2	Push in the ON/OFF switch on the Model 3934 to turn the module on (if required).	The ON/OFF LED is on.
3	Rotate the DISPLAY switch knob to align the pointer with the MEAS line (if required).	
4	Set the PULSE TEST DIRECTION, MEAS FROM switch to the LINE position.	
5	Set the PULSE TEST DIRECTION, SEND TO switch to the EQPT position. **NOTE:** When testing B&G signaling the PULSE TEST DIRECTION, SEND TO and MEAS FROM switches must be set in opposite directions. Setting both switches in the same direction causes an open circuit at the interface jack opposite to the switch settings. This prevents through access to the circuit and does not allow supervision to be sent in the direction of the open circuit.	
6	Set up the B&G interface following the procedures in Section 3.9.2.	
7	Verify the circuit is idle. **NOTE:** If off-hook supervision is detected and the circuit is determined to be in use, the test may be halted.	The EQPT and LINE, INCOMING ON HOOK LEDs are on if the circuit is idle. If the LEDs are off, it indicates off-hook supervision is being received from the direction indicated.

STEP	ACTION	VERIFICATION
8	Toggle the FROM, EQPT-LINE switch towards the LINE label to set up the desired measurement termination (if circuit is idle).	The LINE, OFF HOOK LED is on. The LINE, R TERM or LINE, A- RELAY LED is on. The SPLIT MODE LED is on. The LINE, INCOMING ON HOOK is off.
9	Toggle the TO, EQPT-LINE switch towards the EQPT label to send off-hook supervision (if required). **NOTE:** This will "busy out" the circuit in the direction connected to the EQPT INTERFACE jack.	The EQPT, OFF HOOK LED is on. The EQPT, INCOMING ON HOOK LED is off.
10	Obtain measurements. **NOTE:** The readings are displayed for 5 seconds after the last pulse is received. Pushing the "C" key on the SET keypad will recall the last measurement for another 5 seconds, if no additional pulses are detected. Detection of pulses clears the previous measurement from memory.	The pulse speed (PPS) and % break are displayed.
11	Toggle the MODE, THRU-SPLIT switch towards the THRU label (if testing is complete). **NOTE:** This clears any supervisory signaling being sent by the Model 3934. This also sets up the configuration depicted in Figure 3-15.	The THRU MODE LED is on. The EQPT and LINE, BRIDGE LEDs are on.

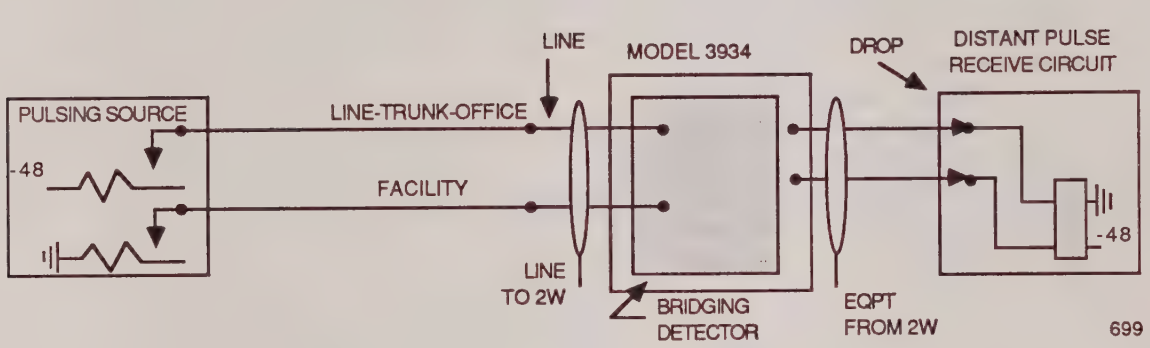


Figure 3-15. Battery and Ground Signaling Measurement Mode - Bridged

3.11.4 Near End Test - Measurement Mode

NOTE: Refer to Figure 3-16 for the Model 3934 configuration described in the following set-up procedures.

STEP	ACTION	VERIFICATION
1	Verify the -48 VDC input is connected.	
2	Push in the ON/OFF switch on the Model 3934 to turn the module on (if required).	
3	Rotate the DISPLAY switch knob to align the pointer with the MEAS line (if required).	

STEP	ACTION	VERIFICATION
4	Set the PULSE TEST DIRECTION, MEAS FROM switch to the EQPT position.	
5	Set the PULSE TEST DIRECTION, SEND TO switch to the LINE position.	
	NOTE: When testing B&G signaling the PULSE TEST DIRECTION, SEND TO and MEAS FROM switches must be set in opposite directions. Setting both switches in the same direction causes an open circuit at the interface jack opposite to the switch settings. This prevents through access to the circuit and does not allow supervision to be sent in the direction of the open circuit.	
6	Set up the B&G interface following the procedures in Section 3.9.2.	

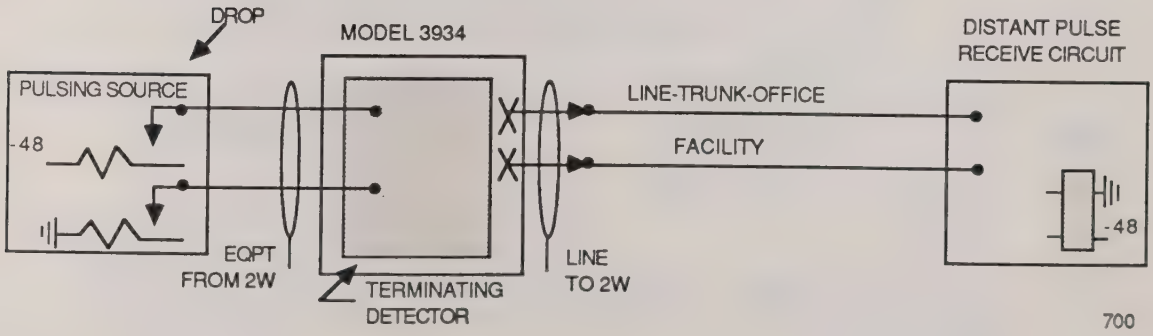


Figure 3-16. Battery and Ground Signaling Measurement Mode - Near End Test (Meas From EQPT)

STEP	ACTION	VERIFICATION
7	Verify the circuit is idle. **NOTE:** If off-hook supervision is detected and the circuit is determined to be in use, the test may be halted.	The EQPT and LINE, INCOMING ON HOOK LEDs are on if the circuit is idle. If the LEDs are off, it indicates off-hook supervision is being received from the direction indicated.
8	Toggle the FROM, EQPT-LINE switch towards the EQPT label to set up the desired measure-ment termination (if circuit is idle). **NOTE:** This will send off-hook supervision in the direction connected to the EQPT INTERFACE jack.	The EQPT, OFF HOOK LED is on. The EQPT, R TERM or EQPT, A-RELAY LED is on. The SPLIT MODE LED is on. The EQPT, INCOMING ON HOOK is off.
9	Toggle the TO, EQPT-LINE switch towards the LINE label to send off-hook supervision (if required). **NOTE:** This will "busy out" the circuit in the direction connected to the LINE INTERFACE jack.	The LINE, OFF HOOK LED is on. The LINE, INCOMING ON HOOK LED is off.

3.12 E&M Signaling Types I, II, and III - DC Pulse Measurement

The Model 3934 supports dc pulse testing in E&M signaling systems, Types I, II & III. Figure 3-17 depicts these three signaling types and the corresponding interface to the Model 3934. It is only necessary to connect the test circuit E&M leads because the Model 3934 provides the proper E lead and M lead conditioning. Since E&M signaling requires a matched interface, the Model 3934 should always be connected to the E&M signaling circuit as indicated in Figure 3-17. This insures that when the circuit is split, the send/measure functions of the Model 3934 appear on the proper lead. This is critical in testing E&M signaling because each lead controls signaling in a specific direction, as indicated in Figure 3-17. Similarly, because each lead has a separate function, the Model 3934 provides for independent control of the E and M leads. Table 3-4 is a listing of the E&M test configurations possible with the

Model 3934 when accessing an E&M circuit as prescribed by Figure 3-17. Although the table lists each send and measure function separately, either SEND TO function can be performed simultaneously with either MEAS FROM function.

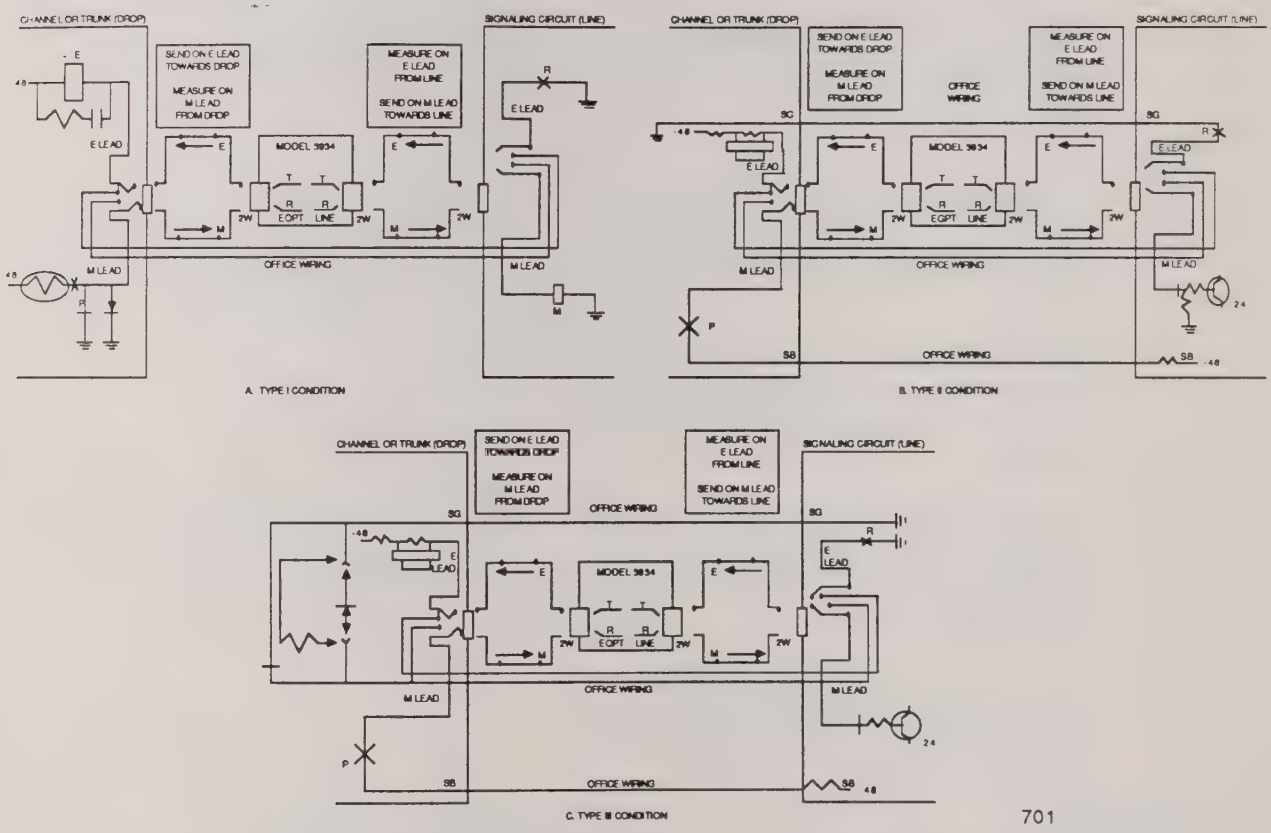


Figure 3-17. E&M Signaling Test Interfaces

TABLE 3-4. E&M SIGNALING TEST CONFIGURATIONS

PULSE TEST DIRECTION SWITCH SETTING		E&M LEAD ACCESS
SEND TO	MEAS FROM	
EQPT	EQPT	E^1
		M^1
LINE	LINE	M^2
		E^2

Notes: [1]Toward the channel or trunk unit via the EQPT 2W jack on the Model 3934
[2]Toward the signaling circuit via the LINE 2W jack on the Model 3934

3.12.1 Send Towards the Channel or Trunk Unit

STEP	ACTION	VERIFICATION
1	Verify the -48V dc input is connected.	
2	Push in the ON/OFF switch on the Model 3934 to turn the Module on (if required).	The ON/OFF LED is on.
3	Set the pulse speed (PPS) following the procedures in Section 3.8.1 (if required). **NOTE:** The pulse speed is automatically set to 10 PPS at "power up" of the module.	
4	Set the % BREAK following the procedures in Section 3.8.2 (if required). **NOTE:** The % Bk is automatically set to 60% Bk at "power up" of the module.	
5	Rotate the DISPLAY switch knob to align the pointer with the MEAS line (if required).	
6	Set the PULSE TEST DIRECTION, SEND TO switch to the EQPT position. **NOTE:** Pulsing will be sent towards the channel or trunk unit on the E lead.	

STEP	ACTION	VERIFICATION
7	Set up the E&M interface following the procedures in Section 3.9.3. **NOTE:** Both the EQPT and LINE, INTERFACE switches must be set to the same E&M type when performing tests in accordance with Figure 3-17.	
8	Verify the circuit is idle. **NOTE:** If off-hook supervision is detected and the circuit is determined to be in use, the test procedure would be halted.	The EQPT and LINE, INCOMING ON HOOK LEDs are on if the circuit is idle. If the LEDs are off, it indicates off-hook supervision is being received from the direction indicated.
9	Toggle the MODE, THRU-SPLIT switch towards the SPLIT label (if circuit is idle). **NOTE:** Both leads are split or open at this point. If you only want to split the E lead in the EQPT direction, send off-hook supervision towards EQPT instead of using the MODE, THRU-SPLIT switch. This splits the E lead and leaves the M lead "THRU" so the channel or trunk unit will send off-hook supervision to the distant end to "busy out" the circuit. When in this condition both the SPLIT and THRU LEDs are on.	

STEP	ACTION	VERIFICATION
10	Toggle the TO, EQPT-LINE switch towards the LINE label to send supervision (if the MODE, THRU-SPLIT switch was used to split the circuit in Step 9). **NOTE:** It may be desirable to send on-hook supervision towards the LINE to maintain an idle indication at the distant end of the circuit. On-hook supervision avoids a possible trouble indication that would result from sending off-hook supervision without pulsing.	The LINE, ON HOOK or OFF HOOK LED is on, depending on which supervision is chosen. If ON HOOK was chosen, the LINE, INCOMING ON HOOK LED is on. If OFF HOOK was chosen the LINE, INCOMING ON HOOK LED is off.
11	Toggle the TO, EQPT-LINE switch towards the EQPT label to send off-hook supervision on the E lead. **NOTE:** This will seize the circuit in the direction connected to the EQPT INTERFACE jack.	The EQPT, OFF HOOK LED is on. The EQPT, INCOMING ON HOOK LED is off.
12	Toggle the SEND switch in the upward direction to the desired pulsing mode to turn the pulse generator on. **NOTE:** Off-hook supervision must be sent in the desired pulsing direction for the pulse generator to operate.	The LED for the selected pulsing SEND mode is on. The EQPT, ON HOOK and OFF HOOK LEDs are flashing alternately. The SEND mode LED labeled "OFF" is on.
13	Toggle the SEND switch in the downward direction to turn the pulse generator off.	The THRU MODE LED is on.

STEP	ACTION	VERIFICATION
14	Toggle the MODE, THRU-SPLIT switch towards the THRU label (if the testing is complete). **NOTE:** This clears any supervisory signaling being sent by the Model 3934.	

3.12.2 Measure From the Channel or Trunk Unit

1	Verify the -48 VDC input is connected.	
2	Push in the ON/OFF switch on the Model 3934 to turn the module on (if required).	The ON/OFF LED is on.
3	Rotate the DISPLAY switch knob to align the pointer with the MEAS line (if required).	
4	Set the PULSE TEST DIRECTION, MEAS FROM switch to the EQPT position. **NOTE:** Measurements will be made on the M lead from the channel or trunk unit.	
5	Set up the E&M interface following the procedures in Section 3.9.3. **NOTE:** Both the EQPT and LINE, INTERFACE switches must be set to the same E&M type when performing tests in accordance with Figure 3-17.	

STEP	ACTION	VERIFICATION
6	Take the bridged mode measurements (if desired). **NOTE:** Once the circuit interface is set up, the Model 3934 will detect and measure pulses on the M lead from the channel or trunk unit. The readings are displayed for 5 seconds after the last pulse is received. Pushing the "C" key on the SET keypad will recall the last measurement for another 5 seconds, if no additional pulses are detected. Detection of pulses clears the previous measurement from memory.	The THRU MODE LED is on. The EQPT, BRIDGE LED is on. The pulse speed (PPS) and % BREAK (% BK) are displayed.
7	Verify the circuit is idle (if terminated measurement is desired). **NOTE:** If off-hook supervision is detected and the circuit is determined to be in use, the test procedure would be halted.	The EQPT and LINE, INCOMING ON HOOK LEDs are on if the circuit is idle. If the LEDs are off, it indicates off-hook supervision is being received from the direction indicated.
8	Toggle the MODE, THRU-SPLIT switch towards the SPLIT label (if the circuit is idle). **NOTE:** Both leads are split or open at this point.	The SPLIT MODE LED is on.
9	Toggle the FROM, EQPT-LINE switch towards the EQPT label to set up a termination on the M lead.	The EQPT, R TERM LED is on.

STEP	ACTION	VERIFICATION
10	Toggle the TO, EQPT-LINE switch towards the EQPT label to send off-hook supervision in the EQPT direction.	The EQPT, OFF HOOK LED is on. The EQPT, INCOMING ON HOOK LED is off.
11	Toggle the TO, EQPT-LINE switch towards the LINE label to send supervision in the LINE direction. NOTE: It may be desirable to send on-hook supervision towards the LINE to maintain an idle indication at the distant end of the circuit. On-hook supervision avoids a possible trouble indication that would result from sending off-hook supervision without pulsing.	The LINE, ON HOOK or OFF HOOK LED is on depending on which supervision is chosen. If ON HOOK was chosen the LINE, INCOMING ON HOOK LED is on. If OFF HOOK was chosen, the LINE, INCOMING ONHOOK LED is off.
12	Take the desired terminated measurements. NOTE: The readings displayed are for pulses detected on the M lead from the channel or trunk.	The pulse speed (PPS) and % break (% BK) are displayed.
13	Toggle the MODE, THRU-SPLIT switch towards the THRU label (if the testing is complete). NOTE: This clears any supervisory signaling being sent by the Model 3934.	The THRU MODE LED is on.

3.12.3 Send Towards the Signaling Circuit

STEP	ACTION	VERIFICATION
1	Verify the -48 VDC input is connected.	

STEP	ACTION	VERIFICATION
2	Push in the ON/OFF switch on the Model 3934 to turn the module on (if required).	The ON/OFF LED is on.
3	Set the pulse speed (PPS) following the procedures in Section 3.8.1 (if required). **NOTE:** The pulse speed is automatically set to 10 PPS at "power up" of the module.	
4	Set the % BREAK following the procedures in Section 3.8.2 (if required). **NOTE:** The % Bk is automatically set to 60% Bk at "power up" of the module.	
5	Rotate the DISPLAY switch knob to align the pointer with the MEAS line (if required).	
6	Set the PULSE TEST DIRECTION, SEND TO switch to the LINE position. **NOTE:** Pulsing will be sent towards the signaling circuit on the M lead.	
7	Set up the E&M interface following the procedures in Section 3.9.3. **NOTE:** Both the EQPT and LINE, INTERFACE switches must be set to the same E&M type when performing tests in accordance with Figure 3-17.	

STEP	ACTION	VERIFICATION
8	Verify the circuit is idle. NOTE: If off-hook supervision is detected and the circuit is determined to be in use, the test procedure would be halted.	The EQPT and LINE, INCOMING ON HOOK LEDs are on if the circuit is idle. If the LEDs are off, it indicates off-hook supervision is being received from the direction indicated.
9	Toggle the MODE, THRU-SPLIT switch towards the SPLIT label (if the circuit is idle). NOTE: Both leads are split or open at this point. If you only want to split the M lead in the LINE direction, send off-hook supervision towards LINE instead of using the MODE, THRU-SPLIT switch. This splits the M lead and leaves the E lead "THRU" so the off-hook supervision sent by the Model 3934 will be returned via the E lead to the channel or trunk unit and "busy out" the circuit. When in this condition, both the SPLIT and THRU LEDs are on.	The SPLIT MODE LED is on.
10	Toggle the TO, EQPT-LINE switch towards the EQPT label to send supervision (if the MODE, THRU-SPLIT switch was used to split the circuit in Step 9). NOTE: If the circuit is split via the MODE, THRU-SPLIT switch it is not necessary to send on-hook supervision in the EQPT direction. Since the split condition leaves the E lead "open" towards the EQPT, it already provides the proper on-hook status.	The EQPT, OFF HOOK LED is on, if off-hook super vision is selected. The EQPT, INCOMING ON HOOK LED is off.

STEP	ACTION	VERIFICATION
11	Toggle the TO, EQPT-LINE switch towards the LINE label to send off-hook supervision on the M lead. **NOTE:** This will seize the circuit in the direction connected to the LINE INTERFACE jack.	The LINE, OFF HOOK LED is on. The LINE, INCOMING ON HOOK LED is off.
12	Toggle the SEND switch in the upward direction to the desired pulsing mode to turn the pulse generator on. **NOTE:** Off-hook supervision must be sent in the desired pulsing direction for the pulse generator to operate.	The LED for the selected pulsing SEND mode is on. The LINE, ON HOOK and OFF HOOK LEDs are flashing alternately.
13	Toggle the SEND switch in the downward direction to turn the pulse generator off.	The SEND mode LED labeled "OFF" is on.
14	Toggle the MODE, THRU-SPLIT switch towards the THRU label (if the testing is complete). **NOTE:** This clears any supervisory signaling being sent by the Model 3934.	The THRU MODE LED is on.

3.12.4 Measure From the Signaling Circuit

STEP	ACTION	VERIFICATION
1	Verify the -48 VDC input is connected.	

STEP	ACTION	VERIFICATION
2	Push in the ON/OFF switch on the Model 3934 to turn the module on (if required).	The ON/OFF LED is on.
3	Rotate the DISPLAY switch knob to align the pointer with the MEAS line (if required).	
4	Set the PULSE TEST DIRECTION, MEAS FROM switch to the LINE position. **NOTE:** Measurements will be made on the E lead from the signaling circuit.	
5	Set up the E&M interface following the procedures in Section 3.9.3. **NOTE:** Both the EQPT and LINE INTERFACE switches must be set to the same E&M type when performing tests in accordance with Figure 3-15.	
6	Take the bridged mode measurements (if desired). **NOTE:** Once the circuit interface is set up, the Model 3934 will detect and measure pulses on the E lead from the signaling circuit. The readings are displayed for 5 seconds after the last pulse is received. Pushing the "C" key on the SET keypad will recall the last measurement for another 5 seconds, if no additional pulses are detected. Detection of pulses clears the previous measurement from memory.	The THRU MODE LED is on. The LINE, BRIDGE LED is on. The pulse speed (PPS) and % break (% BK) are displayed.

STEP	ACTION	VERIFICATION
7	Verify the circuit is idle (if a terminated measured is desired). **NOTE:** If off-hook supervision is detected and the circuit is determined to be in use, the test procedure would be halted.	The EQPT and LINE, INCOMING ON HOOK LEDs are on if the circuit is idle. If the LEDs are off, it indicates off-hook super vision is being received from the direction indicated.
8	Toggle the MODE, THRU-SPLIT switch towards the SPLIT label (if the circuit is idle). **NOTE:** Both leads are split or open at this point.	The SPLIT MODE LED is on.
9	Toggle the FROM, EQPT-LINE switch towards the LINE label to set up termination on the E lead.	The LINE, R TERM LED is on.
11	Toggle the TO, EQPT-LINE switch towards the EQPT label to send off-hook supervision in the EQPT direction (if desired). **NOTE:** Once the E lead is split it is open in the EQPT direction. This open condition provides the proper on-hook supervision, if it is preferred to maintain the circuit in an idle status in this direction.	The EQPT, OFF HOOK LED is on. The EQPT, INCOMING ON HOOK LED is off.
12	Take the terminated measurements. **NOTE:** The readings played are for the pulses detected on the E lead from the signaling circuit.	The pulse speed (PPS) and % break (% BK) are displayed.

STEP	ACTION	VERIFICATION
13	Toggle the MODE, THRU-SPLIT switch towards the THRU label (if the testing is complete). NOTE: This clears any supervisory signaling being sent by the Model 3934.	The THRU MODE LED is on.

3.13 Single Frequency (SF) and Dual Frequency (DF) Signaling - AC Pulse Measurement

The Model 3934 supports two-state ac pulse signaling measurements of both SF and DF signaling systems in either the send or measurement operational mode. SF signaling systems pass the necessary signals for telephone trunks over the VF transmission line facilities without impairing the normal use of these facilities for speech. They deliver and accept dc signals to and from the switching trunk equipment in the form of loop or E&M lead controls and transform those signals to ac on the line side or transmission media. A frequency of 2600 Hz is employed for signaling in both directions on the transmission facility of 4-wire, voice-grade channels of any length and makeup.

DF signaling is similar in concept to SF signaling. The principal difference between SF and DF signaling is that DF systems employ a secondary tone of 2800 Hz as part of the signaling scheme. Trunk seizure or off-hook in DF signaling systems is indicated by the standard removal of the 2600 Hz tone, followed by transmission of the 2800 Hz tone for approximately 175 ms. This scheme helps to minimize false equipment seizures caused by failures in the

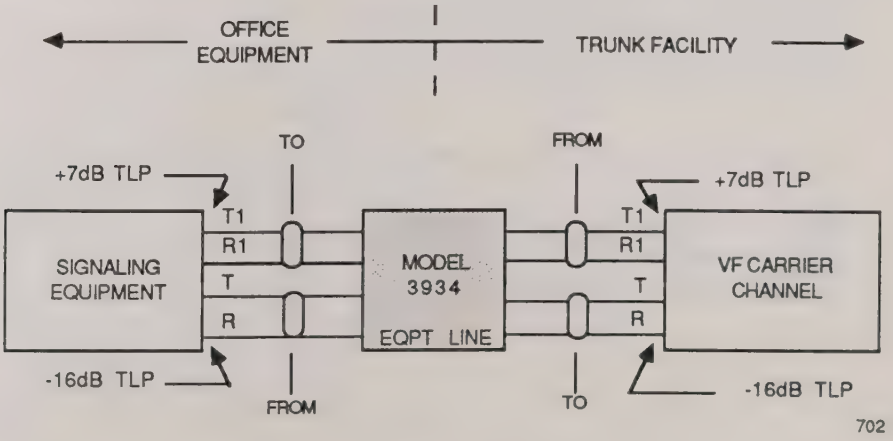


Figure 3-18. SF/DF Signaling Test Configuration

transmission media. Because this feature does not impact how either signaling system is used, testing of these systems can be handled in the same manner. Figure 3-18 is a typical SF or DF signaling system test configuration for the Model 3934. As indicated by this figure, when testing SF or DF signaling the Model 3934 is connected directly to the VF circuit on the line side of the signaling equipment.

3.13.1 Near End Test - Send Mode

STEP	ACTION	VERIFICATION
1	Push in the ON/OFF switch on the Model 3934 to turn the module on (if required).	The ON/OFF LED is on.
2	Set the pulse speed (PPS) following the procedures in Section 3.8.1 (if required). **NOTE:** The pulse speed is automatically set to 10 PPS at "power up" of the module.	
3	Set the % BREAK following the procedures in Section 3.8.2 (if required). **NOTE:** The % Bk is automatically set to 60% Bk at "power up" of the module.	
4	Set the TO LINE TLP following the procedures in Section 3.8.4 (if required). **NOTE:** The TO LINE TLP is automatically set to -16 dB at "power up" of the module.	

STEP	ACTION	VERIFICATION
5	Set the FROM LINE TLP following the procedures in Section 3.8.4 (if required). NOTE: The FROM LINE TLP is automatically set to 7 dB at "power up" of the module.	
6	Set the TO EQPT TLP following the procedures in Section 3.8.4 (if required). NOTE: The TO EQPT TLP is automatically set to 7 dB at "power up" of the module.	
7	Set the FROM EQPT TLP following the procedures in Section 3.8.4 (if required). NOTE: The FROM EQPT TLP is automatically set to -16 dB at "power up" of the module.	
8	Rotate the DISPLAY switch knob to align the pointer with MEAS line (if required).	
9	Set the PULSE TEST DIRECTION, SEND TO switch to the EQPT position.	
10	Determine if the circuit to be tested uses SF or DF signaling.	
11	Set up an SF or DF interface following the procedures in Section 3.9.4, based on the signaling determined in Step 10.	

STEP	ACTION	VERIFICATION
12	Verify the circuit is idle. **NOTE:** If off-hook supervision is detected and the circuit is determined to be in use, the test would be halted.	The EQPT and LINE, INCOMING ON HOOK LEDs are on if the circuit is idle. If the LEDs are off, it indicates off-hook supervision is being received from the direction indicated.
13	Determine if you want to present on-hook or off-hook supervision to the LINE side of the circuit during testing. (On-hook, proceed to Step 16. Off-hook, proceed to Step 14.) **NOTE:** Off-hook supervision will "busy out" the circuit and prevent seizure attempts during testing. On-hook supervision will maintain the LINE side of the circuit in an idle condition. On-hook supervision avoids a possible trouble indication that would result from by sending off-hook supervision without pulsing.	
14	Toggle the TO, EQPT-LINE switch towards the EQPT label to send EQPT direction (if off-hook supervision is to be sent in both directions). **NOTE:** Sending off-hook supervision towards the EQPT splits the equipment receive or TO EQPT pair and leaves the equipment send or FROM EQPT pair "THRU." This THRU circuit will pass the off-hook supervision in the LINE direction.	The EQPT, OFF HOOK LED is on. Both the EQPT and LINE, INCOMING ON HOOK LEDs are off. Both the THRU and SPLIT MODE LEDs are on.

STEP	ACTION	VERIFICATION
15	Toggle the FROM, EQPT-LINE switch towards the LINE label to set up a termination on the FROM LINE pair. (Proceed to Step 21.) **NOTE:** This places a balanced termination on the LINE side of the pair split in Step 14. It prevents any possible circuit imbalance caused by leaving the split pair in an open condition.	The LINE, R TERM LED is on.
16	Toggle the TO, EQPT-LINE switch towards the EQPT label to send on-hook supervision in the EQPT direction (if you want to maintain the circuit in an idle condition in the LINE direction.) **NOTE:** This splits the equipment receive or TO EQPT pair while maintaining the circuit in an idle condition.	The EQPT, ON HOOK LED is on. Both the EQPT and LINE, INCOMING ON HOOK LEDs are on. Both the THRU and SPLIT MODE LEDs are on.
17	Toggle the TO, EQPT-LINE switch towards the LINE label to send on-hook supervision in the LINE direction. **NOTE:** This splits the equipment send or FROM EQPT pair and holds the circuit in an idle condition in the LINE direction.	The EQPT and LINE, ON HOOK LEDs are on. Both the EQPT and LINE, INCOMING ON HOOK LEDs are on. The SPLIT MODE LED is on.

STEP	ACTION	VERIFICATION
18	Toggle the FROM, EQPT-LINE switch towards the LINE label to set up a termination on the FROM LINE pair. **NOTE:** This places a balanced termination on the LINE side of the pair split in Step 16. It prevents any possible circuit imbalance caused by leaving the split pair in an open condition.	The LINE, R TERM LED is on.
19	Toggle the FROM, EQPT-LINE switch towards the EQPT label to set up a termination on the FROM EQPT pair. **NOTE:** This places a balanced termination on the EQPT side of the pair split in Step 17. It prevents any possible circuit imbalance caused by leaving the split pair in an open condition.	The EQPT, R TERM LED is on.
20	Toggle the TO, EQPT-LINE switch towards the EQPT label to send off-hook supervision in the EQPT direction. **NOTE:** This seizes the circuit in the EQPT direction by removing the tone but retains the output termination impedance on the TO EQPT pair.	The EQPT, OFF HOOK LED is on. The EQPT, INCOMING ON HOOK LED is off.

STEP	ACTION	VERIFICATION
21	Toggle the SEND switch in the upward direction to the desired pulsing mode to turn the pulse generator on. NOTE: Off-hook supervision must be sent in the direction corresponding to the direction set on the PULSE TEST DIRECTION, SEND TO switch for the pulse generator to operate.	The LED for the selected pulsing SEND MODE is on. The EQPT, ON HOOK and OFF HOOK LEDs are flashing alternately.
22	Toggle the SEND switch in the downward direction to turn the pulse generator off.	The SEND mode LED labeled "OFF" is on.
23	Toggle the TO, EQPT-LINE switch towards the EQPT label to send on-hook supervision in the EQPT direction (if testing is complete). NOTE: The Model 3934 is now sending a 2600 Hz on-hook tone in both directions on the circuit.	The EQPT, ON HOOK LED is on. The EQPT, INCOMING ON HOOK LED is on.
24	Toggle the MODE, THRU-SPLIT switch towards the THRU label. NOTE: This removes the splits from the circuit and clears the supervision being sent by the Model 3934.	The THRU MODE LED is on. The EQPT and LINE LEDs labeled "NONE" are on.

3.13.2 Near End Test - Measure Mode

STEP	ACTION	VERIFICATION
1	Push in the ON/OFF switch on the Model 3934 to turn the module on (if required).	The ON/OFF LED is on.

STEP	ACTION	VERIFICATION
2	Set the TO LINE TLP following the procedures in Section 3.8.4 (if required). **NOTE:** The TO LINE TLP is automatically set to -16 dB at "power up" of the module.	
3	Set the FROM LINE TLP following the procedures in Section 3.8.4 (if required). **NOTE:** The FROM LINE TLP is automatically set to 7 dB at "power up" of the module.	
4	Set the TO EQPT TLP following the procedures in Section 3.8.4 (if required). **NOTE:** The TO EQPT TLP is automatically set to 7 dB at "power up" of the module.	
5	Set the FROM EQPT TLP following the procedures in Section 3.8.4 (if required). **NOTE:** The FROM EQPT is automatically set to -16 dB at "power up" of the module.	
6	Rotate the DISPLAY switch knob to align the pointer with the MEAS line (if required).	
7	Set the PULSE TEST DIRECTION, MEAS FROM switch to the EQPT position.	

STEP	ACTION	VERIFICATION
8	Determine if the circuit to be tested uses SF or DF signaling.	
9	Set up an SF or DF interface following the procedures in Section 3.9.4, based on the signaling determined in Step 8.	
10	Take the bridged mode measurements (if desired). **NOTE:** Once the circuit interface is set up, the Model 3934 will detect and measure pulses in the FROM EQPT direction corresponding to the setting on the switch in Step 7. The readings are displayed for 5 seconds after the last pulse is received. Pushing the "C" key on the SET keypad will recall the last measurement for another 5 seconds, if no additional pulses are detected. Detection of pulses clears the previous measurement from memory.	The THRU MODE LED is on. The EQPT, BRIDGE LED is on. The pulse speed (PPS) and % break (% BK) are displayed.
11	Verify the circuit is idle (if a terminated measurement is desired). **NOTE:** If off-hook supervision is detected and the circuit is determined to be in use, the test would be halted.	The EQPT and LINE, INCOMING ON HOOK LEDs are on if the circuit is idle. If the LEDs are off, it indicates off-hook supervision is being received from the

STEP	ACTION	VERIFICATION
12	Determine if you want to present on-hook or off-hook supervision to the LINE side of the circuit during testing. (On-hook, proceed to Step 15. Off-hook, proceed to Step 13.) **NOTE:** Off-hook supervision will "busy out" the circuit and prevent seizure attempts during testing. On-hook supervision will maintain the LINE side of the circuit in an idle condition. On-hook supervision avoids a possible trouble indication that would result from sending off-hook supervision without pulsing.	
13	Toggle the TO, EQPT-LINE switch towards the LINE label to send off-hook supervision in the LINE direction (if off-hook supervision is to be sent in both directions). **NOTE:** Sending off-hook supervision towards the LINE splits the equipment send or FROM EQPT pair and leaves the equipment receive or FROM EQPT pair "THRU." This THRU circuit will pass the off-hook supervision in the EQPT direction.	The LINE, OFF HOOK LED is on. Both the EQPT and LINE, INCOMING ON HOOK LEDs are off. Both the THRU and SPLIT MODE LEDs are on.
14	Toggle the FROM, EQPT-LINE switch towards the EQPT label to set up a termination on the FROM EQPT pair. (Proceed to Step 19.)	The EQPT, R TERM LED is on.

STEP	ACTION	VERIFICATION
15	Toggle the TO, EQPT-LINE switch towards the LINE label to send on-hook supervision in the LINE direction (if you want to maintain the circuit in an idle condition in the LINE direction). **NOTE:** This splits the equipment send or FROM EQPT pair and holds the circuit in an idle condition in the LINE direction.	The LINE, ON HOOK LED is on. Both the EQPT and LINE, INCOMING ON HOOK LEDs are on. Both the THRU and SPLIT MODE LEDs are on.
16	Toggle the TO, EQPT-LINE switch towards the EQPT label to send off-hook supervision in the EQPT direction. **NOTE:** This splits the equipment receive or TO EQPT pair and seizes the circuit in that direction.	The EQPT, OFF HOOK LED is on. The EQPT, INCOMING ON HOOK LED is off. The SPLIT MODE LED is on.
17	Toggle the FROM, EQPT-LINE switch towards the LINE label to set up a termination on the FROM LINE pair. **NOTE:** This places a balanced termination on the LINE side of the pair split in Step 16. It prevents any possible circuit imbalance caused by leaving the split pair in an open condition.	The LINE, R TERM LED is on.
18	Toggle the FROM, EQPT-LINE switch towards the EQPT label to set up a termination on the FROM EQPT pair.	The EQPT, R TERM LED is on.

STEP	ACTION	VERIFICATION
19	Take the terminated measurements. NOTE: The readings displayed are for the pulses detected on the equipment send or FROM EQPT pair.	The pulse speed (PPS) and % break (% BK) are displayed.
20	Toggle the TO, EQPT-LINE switch to change the indicated off-hook supervision to on-hook supervision (if the test is complete).	Both the EQPT and LINE, ON HOOK LEDs are on. Both the EQPT and LINE, INCOMING ON HOOK LEDs are on.
21	Toggle the MODE, THRU-SPLIT switch towards the THRU label. NOTE: This removes the splits from the circuit and clears the supervision being sent by the Model 3934.	The THRU MODE LED is on. The EQPT and LINE LEDs labeled "NONE" are on.

3.13.3 Far End Test - Send Mode

STEP	ACTION	VERIFICATION
1	Push in the ON/OFF switch on the Model 3934 to turn the module on (if required).	The ON/OFF LED is on.
2	Set the pulse speed (PPS) following the procedures in Section 3.8.1 (if required).	
3	Set the % BREAK following the procedures in Section 3.8.2 (if required). NOTE: The % Bk is automatically set to 60% Bk at "power up" of the module.	

STEP	ACTION	VERIFICATION
4	Set the TO LINE TLP following the procedures in Section 3.8.4 (if required). NOTE: The TO LINE TLP is automatically set to -16 dB at "power up" of the module.	
5	Set the FROM LINE TLP following the procedures in Section 3.8.4 (if required). NOTE: The FROM LINE TLP is automatically set to 7 dB at "power up" of the module.	
6	Set the TO EQPT TLP following the procedures in Section 3.8.4 (if required). NOTE: The TO EQPT TLP is automatically set to 7 dB at "power up" of the module.	
7	Set the FROM EQPT TLP following the procedures in Section 3.8.4 (if required). NOTE: The FROM EQPT TLP is automatically set to -16 dB at "power up" of the module.	
8	Rotate the DISPLAY switch knob to align the pointer with the MEAS line (if required).	
9	Set the PULSE TEST DIRECTION, SEND TO switch to the LINE position.	

STEP	ACTION	VERIFICATION
10	Determine if the circuit to be tested uses SF or DF signaling.	
11	Set up an SF or DF interface following the procedures in Paragraph 3. , based on the signaling determined in Step 10.	
12	Verify the circuit is idle. **NOTE:** If off-hook supervision is detected and the circuit is determined to be in use, the test would be halted.	The EQPT and LINE, INCOMING ON HOOK LEDs are on if the circuit is idle. If the LEDs are off, it indicates off-hook supervision is being received from the direction indicated.
13	Determine if you want to present on-hook or off-hook supervision to the EQPT side of the circuit during testing. (On-hook, proceed to Step 16. Off-hook, proceed to Step 14.) **NOTE:** Off-hook supervision will "busy out" the circuit and prevent seizure attempts during testing. On-hook supervision will maintain the EQPT side of the circuit in an idle condition. On-hook supervision avoids a possible trouble indication that would result from sending off-hook supervision without pulsing.	

STEP	ACTION	VERIFICATION
14	Toggle the TO, EQPT-LINE switch towards the LINE label to send off-hook supervision in the LINE direction (if off-hook supervision is to be sent in both directions). **NOTE:** Sending off-hook supervision towards the LINE splits the line send or TO LINE pair and leaves the line receive or FROM LINE pair "THRU". This THRU circuit will pass the off-hook supervision in the LINE direction.	The LINE, OFF HOOK LED is on. Both the EQPT and LINE, INCOMING ON HOOK LEDs are off. Both the THRU and SPLIT MODE LEDs are on.
15	Toggle the FROM, EQPT-LINE switch towards the EQPT label to set up a termination on the FROM EQPT pair. (Proceed to Step 21.) **NOTE:** This places a balanced termination on the EQPT side of the pair split in Step 14. It prevents any possible circuit imbalance caused by leaving the split pair in an open condition.	The LINE, R TERM LED is on.
16	Toggle the TO, EQPT-LINE switch towards the LINE label to send on-hook supervision in the LINE direction (if you want to maintain the circuit in an idle condition in the EQPT direction). **NOTE:** This splits the line send or TO LINE pair while maintaining the circuit in an idle condition.	The LINE, ON HOOK LED is on. Both the EQPT and LINE, INCOMING ON HOOK LEDs are on. Both the THRU and SPLIT MODE LEDs are on.

STEP	ACTION	VERIFICATION
17	Toggle the TO, EQPT-LINE switch towards the EQPT label to send on-hook supervision in the EQPT direction. **NOTE:** This splits the line receive or FROM LINE pair and holds the circuit in an idle condition in the EQPT direction.	The EQPT and LINE, ON HOOK LEDs are on. Both the EQPT and LINE, INCOMING ON HOOK LEDs are on. The SPLIT MODE LED is on.
18	Toggle the FROM, EQPT-LINE switch towards the LINE label to set up a termination on the FROM LINE pair. **NOTE:** This places a balanced termination on the LINE side of the pair split in Step 17. This prevents any possible circuit imbalance caused by leaving the split pair in an open condition.	The LINE, R TERM LED is on.
19	Toggle the FROM, EQPT-LINE switch towards the EQPT label to set up a termination on the FROM EQPT pair. **NOTE:** This places a balanced termination on the EQPT side of the pair split in Step 16. It prevents any possible circuit imbalance caused by leaving the split pair in an open condition.	The EQPT, R TERM LED is on.

STEP	ACTION	VERIFICATION
20	Toggle the TO, EQPT-LINE switch towards the LINE label to send off-hook supervision in the LINE direction. **NOTE:** This seizes the circuit in the LINE direction by removing the tone but retains the output termination impedance on the TO LINE pair.	The LINE, OFF HOOK LED is on. The LINE, INCOMING ON HOOK LED is off.
21	Toggle the SEND switch in the upward direction to the desired pulsing mode to turn the pulse generator on. **NOTE:** Off-hook supervision must be sent in the direction corresponding to the direction set on the PULSE TEST DIRECTION, SEND TO switch for the pulse generator to operate.	The LED for the selected pulsing SEND MODE is on. The LINE, ON HOOK and OFF HOOK LEDs are flashing alternately.
22	Toggle the SEND switch in the downward direction to turn the pulse generator off.	The SEND mode LED labeled "OFF" is on.
23	Toggle the TO, EQPT-LINE switch towards the LINE label to send on-hook supervision in the LINE direction (if testing is complete). **NOTE** The Model 3934 is now sending a 2600 Hz on-hook tone in both directions on the circuit.	The LINE, ON HOOK LED is on. The LINE, INCOMING ON HOOK LED is on.

STEP	ACTION	VERIFICATION
24	Toggle the MODE, THRU-SPLIT switch towards the THRU label. **NOTE:** This removes the splits from the circuit and clears the supervision being sent by the Model 3934.	The THRU MODE LED is on. The EQPT and LINE LEDs labeled "NONE" are on.

3.13.4 Far End Test - Measure Mode

STEP	ACTION	VERIFICATION
1	Push in the ON/OFF switch on the Model 3934 to turn the module on (if required).	The ON/OFF LED is on.
2	Set the TO LINE TLP following the procedures in Section 3.8.4 (if required). **NOTE:** The TO LINE TLP is automatically set to -16 dB at "power up" of the module.	
3	Set the FROM LINE TLP following the procedures in Section 3.8.4 (if required). **NOTE:** The FROM LINE TLP is automatically set to 7 dB at "power up" of the module.	
4	Set the TO EQPT TLP following the procedures in Section 3.8.4 (if required). **NOTE:** The TO EQPT TLP is automatically set to 7 dB at "power up" of the module.	

STEP	ACTION	VERIFICATION
5	Set the FROM EQPT TLP following the procedures in Section 3.8.4 (if required). NOTE: The FROM EQPT TLP is automatically set to -16 dB at "power up" of the module.	
6	Rotate the DISPLAY switch knob to align the pointer with the MEAS line (if required).	
7	Set the PULSE TEST DIRECTION, MEAS FROM switch to the LINE position.	
8	Determine if the circuit to be tested uses SF or DF signaling.	
9	Set up an SF or DF interface following the procedures in Section 3.9.4, based on the signaling determined in Step 8.	
10	Take the bridged mode measurements. NOTE: Once the circuit interface is set up, the Model 3934 will detect and measure pulses in the FROM LINE direction corresponding to the setting on the switch in Step 7. The readings are displayed for 5 seconds after the last pulse is received. Pushing the "C" key on the SET keypad will recall the last measurement for another 5 seconds, if no additional pulses are detected. Detection of pulses clears the previous measurement from memory.	The THRU MODE LED is on. The LINE, BRIDGE LED is on. The pulse speed (PPS) and % break (% BK) are displayed.

STEP	ACTION	VERIFICATION
11	Verify the circuit is idle (if a terminated measurement is desired). desired). **NOTE:** If off-hook supervision is detected and the circuit is determined to be in use, the test would be halted.	The EQPT and LINE, INCOMING ON HOOK LEDs are on if the circuit is idle. If the LEDs are off, it indicates off-hook supervision is being received from the direction indicated.
12	Determine if you want to present on-hook or off-hook supervision to the EQPT side of the circuit during testing. (On-hook proceed to Step 15. Off-hook, proceed to Step 13.) **NOTE:** Off-hook supervision will "busy out" the circuit and prevent seizure attempts during testing. On-hook supervision will maintain the EQPT side of the circuit in an idle condition. On-hook supervision avoids a possible trouble indication that would result from sending off-hook supervision without pulsing.	
13	Toggle the TO, EQPT-LINE switch towards the EQPT label to send off-hook supervision in the EQPT direction (if off-hook supervision is to be sent in both directions). **NOTE:** Sending off-hook supervision towards the EQPT splits the line receive or FROM LINE pair and leaves the line send or TO LINE pair "THRU". This THRU circuit will pass the off-hook supervision in the LINE direction.	The EQPT, OFF HOOK LED is on. Both the EQPT and LINE, INCOMING ON HOOK LEDs are off. Both the THRU and SPLIT MODE LEDs are on.

STEP	ACTION	VERIFICATION
14	Toggle the FROM, EQPT-LINE switch towards the LINE label to set up a termination on the FROM LINE pair. (Proceed to Step 19). **NOTE:** This places a balanced termination on the LINE side of the pair split in Step 13. It prevents any possible circuit imbalance caused by leaving the split pair in an open condition.	The LINE, R TERM LED is on.
15	Toggle the TO, EQPT-LINE switch towards the EQPT label to send on-hook supervision in the EQPT direction (if you want to maintain the circuit in an idle condition in the EQPT direction). **NOTE:** This splits the line receive or FROM LINE pair and holds the circuit in an idle condition in the EQPT direction.	The EQPT, ON HOOK LED is on. Both the EQPT and LINE, INCOMING ON HOOK LEDs are on. Both the THRU and SPLIT MODE LEDs are on.
16	Toggle the TO, EQPT-LINE switch towards the LINE label to send off-hook supervision in the LINE direction. **NOTE:** This splits the line send or TO LINE pair and seizes the circuit in that direction.	The LINE, OFF HOOK LED is on. The LINE, INCOMING ON HOOK LED is off. The SPLIT MODE LED is on.

STEP	ACTION	VERIFICATION
17	Toggle the FROM, EQPT-LINE switch towards the EQPT label to set up a termination of the FROM EQPT pair. **NOTE:** This places a balanced termination on the EQPT side of the pair split in Step 16. It prevents any possible circuit imbalance caused by leaving the split pair in an open condition.	The EQPT, R TERM LED is on.
18	Toggle the FROM, EQPT-LINE switch towards the LINE label to set up a termintaion on the FROM LINE pair.	The LINE, R TERM LED is on.
19	Take the terminated measurements. **NOTE:** The readings displayed are for the pulses detected on the line receive of FROM LINE pair.	The pulse speed (PPS) and % break (% BK) are displayed.
20	Toggle the TO, EQPT-LINE switch to change the indicated off-hook supervision to on-hook supervision (if the test is complete).	Both the EQPT and LINE, ON HOOK LEDs are on. Both the EQPT and LINE, INCOMING ON HOOK LEDs are on.
21	Toggle the MODE, THRU-SPLIT switch towards the THRU label. **NOTE:** This removes the splits from the circuit and clears the supervision being sent by the Model 3934.	The THRU MODE LED is on. The EQPT and LINE LEDs labeled "NONE" are on.

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SECTION 4 - INSTALLATION/REMOVAL

This section describes how to install or remove the module.

> **WARNING:** TURN OFF the Model 3901 CTS Basic Unit power before module installation or removal to avoid possible damage to the unit. The Basic Unit power is off when the POWER switch is in the out position.

To install the module, proceed as follows:

> **WARNING:** DO NOT HANDLE the module by the rear edge connector as static electricity discharged through this connector may cause damage to the CMOS IC's on the board(s).

STEP	ACTION
1	Align the module's PC the Basic Unit or Model 3910 Expander unit slot.
2	Push the module in until the extractor rod contacts the extractor standoff.
3	Turn the extractor screw counter-clockwise while gently pushing the module into the edge connector.
4	Tighten the extractor screw until the module is firmly in place.

To remove the module, proceed as follows:

STEP	ACTION
1	Turn the extractor screw counter-clockwise until it turns freely.
2	Remove the module by pulling it forward.

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SECTION 5 - PACKING, SHIPPING, AND RETURN TO FACTORY

This section contains directions for the packaging and shipment of the module, and special instructions for identification, and tagging when returning the module to HLI for servicing or repair.

> **WARNING:** DO NOT HANDLE the module by the rear edge connector as static electricity discharged through this connector may cause damage to the CMOS IC's on the board(s).

A. RETURN FOR SERVICING OR REPAIR

If the module is being returned to HLI for servicing or repair, enclose the following information:

- Type of service or repair required.
- Model and serial number of the Basic Unit and/or Expander Unit from which the module was extracted.
- Model and serial number of the module.
- Your name, return address and telephone number.
- Return authorization number, if any.

Retain a copy of all information for yourself and refer to this information in any correspondence with HLI.

B. PACKING AND SHIPPING

Modules shipped separately from the factory are enclosed in a special conductive envelope to prevent damage from static electricity build up during shipping. It is important to retain this envelope and use it when reshipment is required.

To package the module proceed as follows:

STEP	ACTION
1	Cover the entire rear edge connector with a conductive shorting bar, if available.
2	Place the module in the conductive envelope retained for this purpose. If the envelope is not available, wrap the module in heavy kraft paper.

WARNING: Under no circumstances should you wrap the module in an ordinary plastic bag or plastic sheeting. This may cause static electricity build up and result in possible damage to the CMOS IC's on the board(s).

3	Insert the wrapped module in a strong shipping container.
4	Surround the packaged module with 2 to 4 inches (5 to 10 cm.) thick shock-absorbing material. Common newspapers may be used for this purpose.
5	Mark the container: FRAGILE DELICATE ELECTRONIC INSTRUMENT.